

THE PAN-PACIFIC ENTOMOLOGIST



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THE PAN-PACIFIC ENTOMOLOGIST

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Published quarterly in January, April, July, and October with Society Proceedings appearing in the January number. All communications regarding nonreceipt of numbers, requests for sample copies, and all financial communications should be addressed to the Treasurer, Dr. Paul H. Arnaud, Jr., California Academy of Sciences, Golden Gate Park, San Francisco, California 94118.

Application for membership in the Society and changes of address should be addressed to the Secretary, Dr. Carlton S. Koehler, 112 Agriculture Hall, University of California, Berkeley, California 94720.

The annual dues, paid in advance, are \$5.00 for regular members of the Society or \$6.00 for subscriptions only. Single copies are \$1.50 each or \$6.00 a volume. Make checks payable to *Pan-Pacific Entomologist*.

The Pacific Coast Entomological Society

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STATEMENT OF OWNERSHIP

Title of Publication: The Pan-Pacific Entomologist

Frequency of Issue: Quarterly (January, April, July, October)

Location of Office of Publication, Business Office of Publisher, Publisher and Owner: Pacific Coast Entomological Society, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118.

Editor: Dr. Howell V. Daly, 112 Agriculture Hall, University of California, Berkeley, California 94720.

Managing Editor and Known Bondholders or other Security Holders: none.

This issue mailed 30 March 1964.

Second Class Postage Paid at Lawrence, Kansas, U.S.A.

THE ALLEN PRESS

PRINTED
IN
U. S. A.

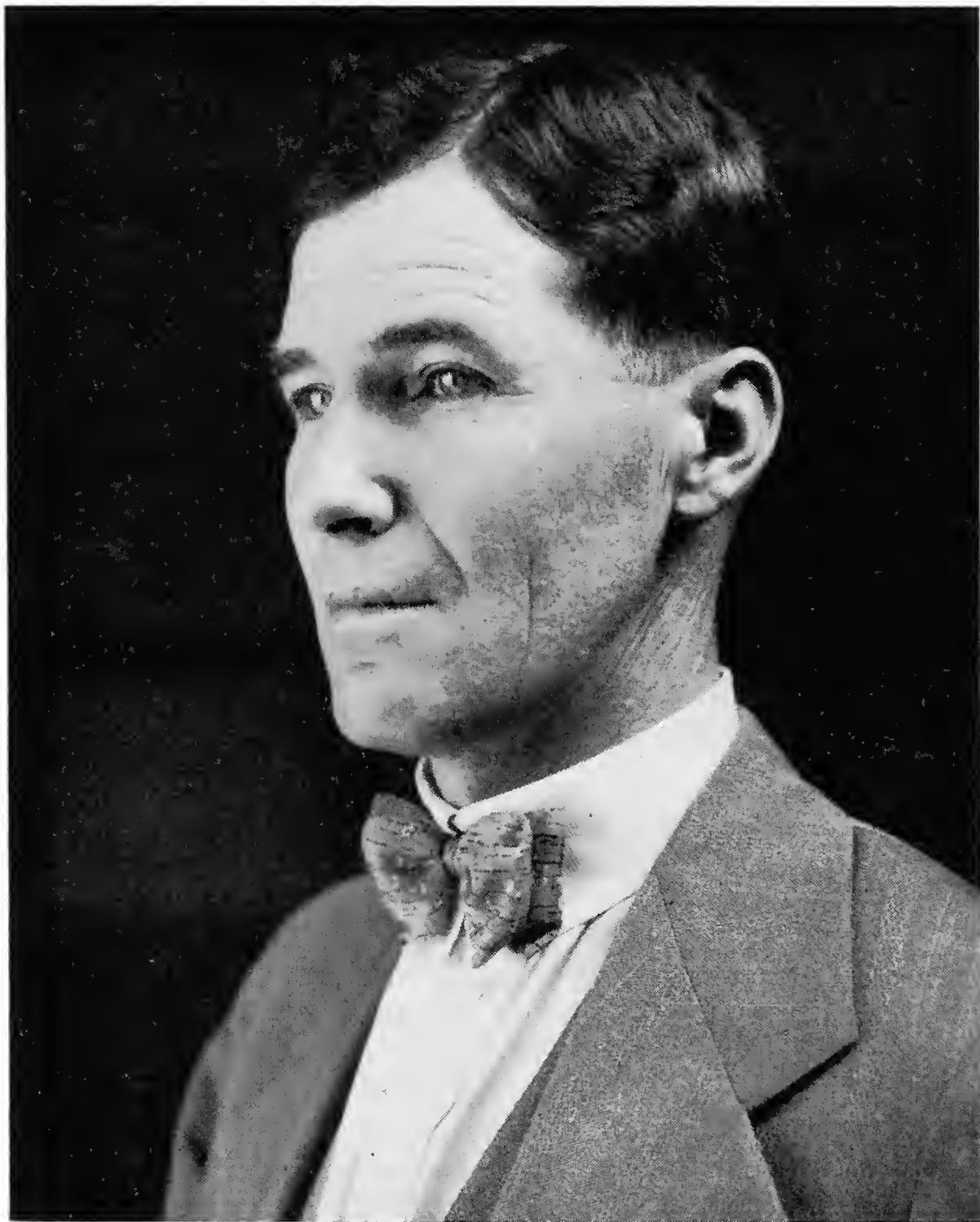
LAWRENCE, KANSAS

The Pan-Pacific Entomologist

Vol. 40

JANUARY 1964

No. 1



John Elliot Patterson

1887-1962

JOHN ELLIOT PATTERSON

One of the last of that vanishing race of naturalists whose knowledge was largely self-taught passed from the scene with the death of John Elliot Patterson in Ashland, Oregon, on 31 July 1962. John Patterson was a forest entomologist whose 32-year career was practically all devoted to investigations of insect pests in the forests of California and Oregon. A colleague and contemporary of such well-known workers in this field as H. E. Burke, J. M. Miller, and F. P. Keen, he was one of a small band of pioneers in the U. S. Department of Agriculture who laid the groundwork for the development of forest insect research in the West as we know it today.

John was born on 26 November 1887, in Joplin, Missouri, the son of John T. and Naomi Sheets Patterson, who came from Kentucky. Two years thereafter, in the aftermath of the great migrations which helped settle the West, the family moved to southern Oregon. There on a farm near Klamath Falls John grew up. He received his formal education in the Klamath Falls schools, and later attended for a time Southern Oregon Normal School in Ashland. A young man who felt keenly the challenges of a rapidly growing technology, but who was impatient with the conventional processes of education, John forsook the halls of learning early "to see for himself." Before finding the niche out of which he carved his career, he was successively a surveyor's helper, an apprentice to a commercial photographer, a wiring specialist on railroad signal installations, and a salesman of packinghouse products. Just what turned his interests from these ventures to forestry is not clear; but we do know that from his numerous experiences and native ability he became a skilled technician in many fields. He learned early in life to be self-reliant, and this trait characterized his entire career. In addition, he stored up a wealth of knowledge which stood him in good stead on many a later occasion when some practical problem stumped a colleague with a less varied background.

In 1913, when he was 26 years old, John became a forest guard on the Crater (now Rogue River) National Forest. He started his forest entomology career in the spring of the following year as an entomological ranger at the Ashland, Oregon, field station of the U. S. Bureau of Entomology. Placed in charge of this station 6 years later, he remained at Ashland until 1925, when this installation was closed and the work transferred to the Bureau's Pacific Slope Station at Stanford University, Palo Alto, California. John left the Federal Service to engage in private business for a 4-year period beginning in July 1929, but early in 1934 he rejoined the Bureau, which meantime

had shifted its forest insect activities from Stanford to the University of California at Berkeley. Thenceforward until his retirement on 7 July 1950, he was a mainstay of the staff of the Berkeley Forest Insect Laboratory. During the last 8 years of his active career he was Assistant Station Leader, responsible for administering the Laboratory's program.

At the close of his career, John returned to the home at Ashland, planned and built by his own hand, which had remained his legal residence throughout his years in California. There he vigorously pursued his many interests until his death of cancer in 1962. His wife, Myrtle Vivian DeCarlow, whom he married in 1917, survives him.

John Patterson's contributions to forest entomology were many. When his career began, the first large-scale projects to control pine bark beetles in western forests were in their heyday. His interest in forest insects undoubtedly was first aroused by experiences on these projects. Through such experiences, he acquired a wealth of knowledge about bark beetles, and a strong background in methods of surveying and controlling these pests. This knowledge, coupled with his special talents for getting people with diverse interests to work together harmoniously, placed him much in demand on survey and control projects in later years. He made important additions to our information on bark beetle ecology and originated the idea of using solar heat in controlling the mountain pine beetle. He also helped to develop the first major study of cone and seed insects of western forest trees, and was the first to conduct detailed biological studies of two important defoliating pests of conifers, the lodgepole needle miner and the pandora moth.

Some of John Patterson's accomplishments are well documented in the dozen or so publications that he authored, but he was not a prolific writer. Perhaps his greatest single tangible legacy to forest entomology stems from his days as an apprentice photographer, for photography was a field in which he had not only a strong interest but considerable talent. Pictures that he took of western forest insects and their work have been used in many government publications, as well as in a number of forest entomology texts. Taken in a day when photographic equipment was far less sophisticated than it is now, many of his forest insect pictures remain unexcelled today.

Ornithology was another one of John Patterson's avocations. Some of his observations and many excellent photographs which he took of birds and bird habitats appear in publications on the natural history of North American birds, from the Smithsonian press. He also developed

during the latter part of his career a superb collection of stereo color photographs of California scenes, some of the best depicting the State's famous Spanish missions.

Those of us who were his close associates best remember "Pat," as we called him, for his many admirable qualities as a person. A friendly, tactful individual, not readily upset when plans went awry, he had a knack for dealing with people that gained him a considerable reputation as a troubleshooter. His interest in the activities of those around him, particularly newcomers just getting started, was unflagging. And his practical versatility helped many a fellow worker bring into being a brainchild that otherwise would have been stillborn. "Pat" was a gracious and entertaining host, a congenial traveling companion, and an experienced field man, wise in woods ways. An avid reader, a keen observer, and a man with a lively curiosity concerning the world about him, John Patterson never lost the urge "to see for himself." —CHARLES B. EATON AND GEORGE R. STRUBLE, *Pacific Southwest Forest and Range Experiment Station, Forest Service, U. S. Department of Agriculture*.

A New Gall Midge from Prickly Pear Cactus in Arizona

(Diptera : Cecidomyiidae)

G. ALLAN SAMUELSON¹

University of Arizona, Tucson

In 1960, I reared adult midges representing a new *Ruebsaamenia* from collections of fruit of Prickly Pear cacti, *Opuntia* (*Platyopuntia*) taken in southern Arizona. Larvae and pupae were also collected. The life history of this species is partially described here, and is of interest since little is published on the bionomics of the North American members of this tribe, the Porricondylini.

Members of this genus are mostly recorded from the Palaearctic Region. The first record of the occurrence of *Ruebsaamenia* in North America is believed to be that of Foote (1956) in which *R. keeni* is described and is associated with the cones of *Abies*, *Picea*, *Pinus*, and *Pseudotsuga* in California.

Ruebsaamenia cactophila Samuelson, new species

HOLOTYPE MALE: Body reddish-orange in life, fading to shades of yellowish-buff after death; eyes black. Head with row of long setae along hind margin of eye; mesonotum setose laterally, pseudosutural foveae ciliate, pleurae mostly glabrous, scutellum with transverse row of long setae; abdomen moderately clothed with long setae.

Head nearly circular as viewed from front, ovate from lateral aspect; eye bridge with about nine rows of facets; maxillary palpus four-segmented, with overall length attaining height of head, segment two widest, three slightly thicker than four, length of segments forming a ratio of 1.0 : 1.7 : 2.4 : 3.3. *Antenna* 23-segmented, slightly longer than body, most flagellar segments with long stem; scape subconical, widest subapically, slightly longer than wide; pedicel subquadrate, with sides slightly turgid, about half as long as scape; third segment about three times longer than pedicel, constricted basad of node; segments 4–13 subequal, slightly longer than third, node basal; 14–21 gradually decreasing in length; 22 about a third as long as 21, without a produced stem; last segment conical, apically pointed, slightly longer than 22. Fifth flagellar segment with lengths of stem and node about equal; cylindrical, with diameter of node over twice as great as stem; stem slightly enlarged subapically, glabrous; node weakly constricted at middle, clothed with very fine, erect setae supplemented with three conspicuous whorls of long setae; basal whorl of stout setae, about a third as long as segment; subapical whorl with setae arising from swollen, elliptical bases, length almost twice as long as segment; apex of node with whorl of fine setae, length subequal to segment; circumfilum a single closely fitting ring on basal third of node. *Thorax* with pseudosutural foveae attaining anterior margin of mesonotum, apically converging and forming a triangular region on mesonotum. Wing hyaline, moderately clothed with macrotrichia, about 2.4 times longer than broad; R_1 ending in costa at basal

¹ New address: Bernice P. Bishop Museum, Honolulu.

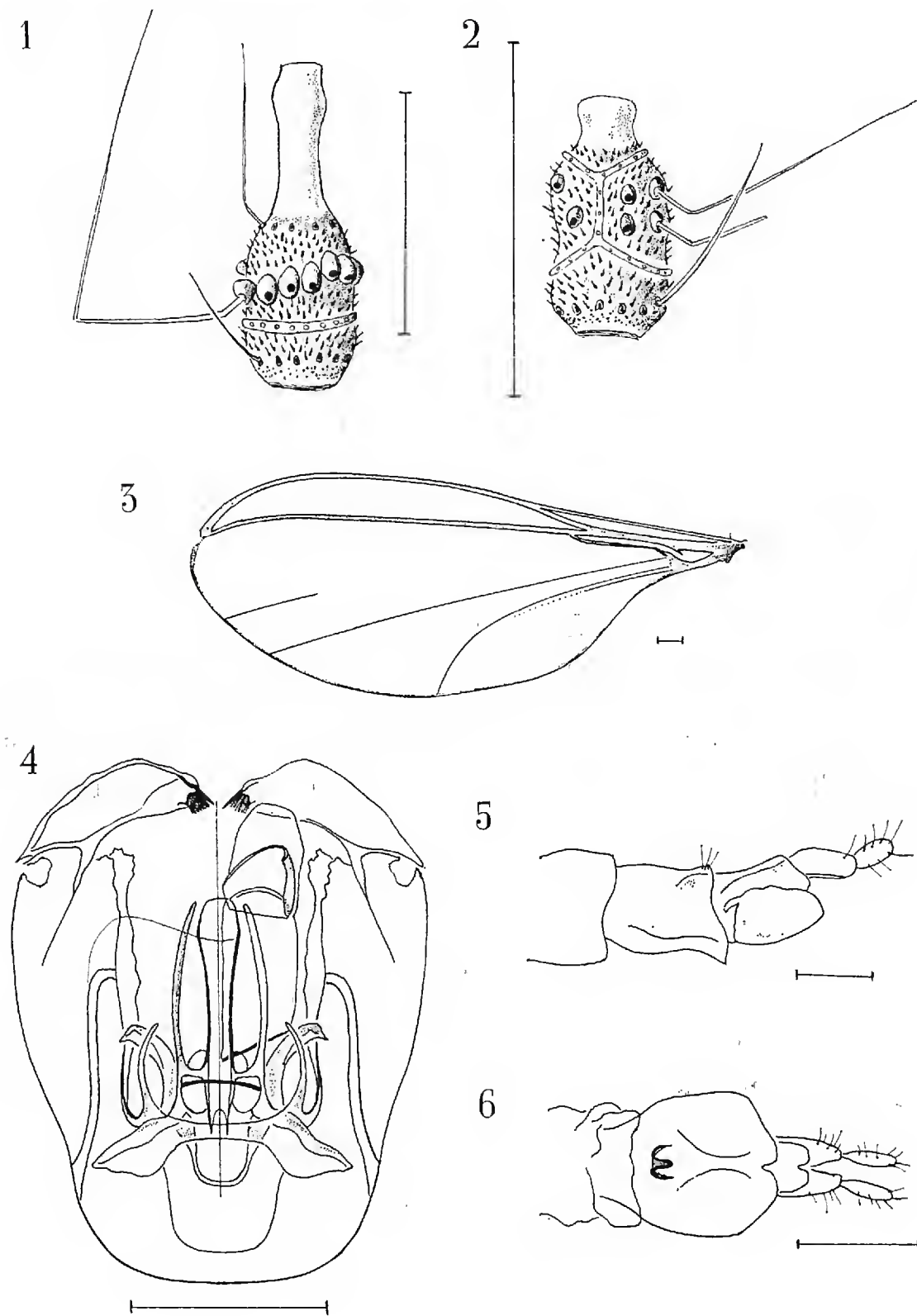
third; R_s nearly parallel to costa; R_5 gently curving apically, joining costa slightly before apex of wing; M_{3+4} nearly straight, attaining costa, becoming faint basally; Cu simple, apically curving to meet costa; postcubitus faint, ending near curve of cubitus. Legs long; lengths of hind tarsomeres forming a ratio of 1.0 : 11.0 : 6.0 : 3.3 : 1.5; claws with strongly curved basal tooth, nearly two-thirds as long as claw; empodium slightly exceeding length of claw. *Abdomen* with apical segments and genitalia curving dorsally over subapical portion. *Genitalia* 1.2 times longer than wide; basistyle subrectangular, 2.2 times longer than wide, apical fourth armed with short spines and tubercles on inner surface; dististyle slightly curved, about 3.3 times longer than wide, widest subapically, then narrowing to a curved apex armed with a single stout tooth subtended by about eight stiff spines; tenth tergite deeply and narrowly excised, each side rounded apically, length nearly attaining apex of dististyle; tenth sternite nearly hyaline, weakly emarginate, length not attaining apex of basistyle; aedeagus with apex truncate, dilated subapically; parameres as in drawing. *Length*: 2.0 mm.

ALLOTYPE FEMALE: Differing from male in the following characters: maxillary palpus with length of segments forming a ratio of 1.0 : 1.9 : 2.7 : 3.7. Antenna 22-segmented, about half as long as body, most flagellar segments short, slightly longer than broad, with a short stem about a fourth as long as segment; scape subconical, widest subapically, slightly longer than wide; pedicel about three-fifths as long as scape, sides swollen, slightly longer than broad; third segment constricted basad of node, slightly longer than scape and fourth segment; segments 4–21 mostly subequal, with apical segments gradually decreasing in length; last segment apically pointed, nearly twice as long as 21. Fifth flagellar segment with node clothed with small, erect setae supplemented with three whorls of long setae; basal whorl of stout setae, length about as long as segment; middle whorl of long setae arising from swollen elliptical bases, length 1.4 times as long as segment; apex of node with whorl of fine setae, length about half as long as segment; circumfilum consisting of two interconnected, closely fitting rings. Hind tarsomeres with lengths forming a ratio of 1.0 : 9.3 : 5.7 : 3.0 : 1.5. Genitalia not adapted for piercing; apex with paired, two-segmented lobes; proximal lobe about 1.5 times longer than distal; apex with a ventral, emarginate plate extending beneath basal half of proximal lobes; ultimate lobe compressed. *Length*: 2.3 mm.

PARATYPES: 19 males, body length 2.2–2.6 mm (mean 2.4); length ratio of palpal segments 1.0 : 1.7 : 2.3 : 3.0 to 1.0 : 2.0 : 2.5 : 3.7 (mean 1.0 : 1.8 : 2.4 : 3.3); antennal segments 22–24; wing length 2.0–2.5 mm (mean 2.2); length ratio of hind tarsomeres 1.0 : 10.4 : 6.0 : 3.2 : 1.4 to 1.0 : 12.5 : 7.0 : 3.8 : 1.8 (mean 1.0 : 11.4 : 6.5 : 3.4 : 1.5); 61 females, body length 1.5–2.9 mm (mean 2.3); length ratio of palpal segments 1.0 : 1.5 : 2.0 : 2.4 to 1.0 : 2.5 : 3.3 : 4.4 (mean 1.0 : 1.8 : 2.3 : 3.3); antennal segments 20–26; wing length 1.8–2.5 mm (mean 2.1); length ratio of hind tarsomeres 1.0 : 8.8 : 4.8 : 2.4 : 1.3 to 1.0 : 14.5 : 8.0 : 4.5 : 1.8 (mean 1.0 : 11.0 : 6.3 : 3.4 : 1.5).

Sex ratio 10 males : 31 females.

EGG: Not seen. **LARVA:** Last instar. Intense reddish-orange in life. Head mostly retracted within prothorax; antenna one-segmented, cylindrical, about 2.7 times longer than broad. Thorax of four glabrous annulets; first annulet small; second slightly longer than first, bearing prothoracic spiracles and spatula; third slightly longer than first plus second; fourth largest, exceeding combined length of first three, dilated on ventroanterior margin. Prothoracic spiracle subtriangular, widest



EXPLANATION OF FIGURES

Fig. 1, fifth flagellar antennal segment of male. Fig. 2, fifth flagellar antennal segment of female. Fig. 3, left wing. Fig. 4, male genitalia, ventral view, showing tenth sternal plate on left and tenth tergal plate on right. Fig. 5, female genitalia, lateral view. Fig. 6, female genitalia, ventral view. (scales = 0.1 mm)

at apex, about 2.2 times longer than wide. Spatula of two distinct, narrowly separated sclerites on ventromeson; each part laterally expanded basad, then narrowing to a weakly hooked apex. Abdomen with segments one to seven plicate, bearing spiracles and small, conical prolegs; anal region without conspicuous ornamentation. Length: 2.1–2.7 mm. PUPA: Mostly reddish-orange, with eyes, wing pads, and femora becoming darker as imago matures. Head with two prominent bristles arising near vertex; antennal envelope lacking projections; facial region lacking frontal and postfrontal projections. Thorax with mesonotum glabrous. Abdomen with sculpture finely punctulate; lateral papillae present on segments one to seven; last segment with a pair of fleshy, apically pointed lobes. Length: 1.9–2.4 mm.

Holotype male, FLORIDA CANYON, SANTA RITA MOUNTAINS, PIMA COUNTY, ARIZONA, 14–15 May 1960, G. Allan Samuelson, collector; allotype female, same data; 69 paratypes, same location, 14–15 May, 3 July 1960, K. Roever, Samuelson; 11 paratypes, 8 miles southeast Continental, 2 April 1960, Samuelson. All specimens were reared. Holotype and allotype deposited in United States National Museum, number 65893.

This entity differs from *R. keeni* Foote by the following: male with apex of dististyle armed with one heavy tooth subtended by about eight stiff spines instead of two heavy, apical teeth with a comblike row of stiff spines along apical fourth of inner margin of dististyle; female with fifth flagellar antennal segment bearing two interconnected, circumfilar rings instead of one ring.

BIONOMICS

This species is evidently mycophagous as it has been reared only from decaying fruits of *Opuntia*. Invariably, fruits which have produced this midge have been persistent on the plant, moist, and in partial decay due to an undetermined fungus. Many of these fruits had been infested earlier by another cecidomyiid, *Asphondylia opuntiae* Felt, as noted by conspicuous emergence holes and by the presence of pupal exuviae in some of the exit holes. The presence of these emergence holes does not seem to cause the fruit to become desiccated, although their presence may encourage infection by the fungus.

Feeding presumably takes place within the fruit, as larvae have been noted in areas occupied by fresh mycelium and spore capsules of the fungus. No evidence of larval activity was seen in the occasional clean, moist areas of the fruit adjacent to the decaying portions. Pupation takes place on the surface of the fruit within a low tent constructed of glochids (minute cactus spines). During the construction of these tents, the larvae were quite gregarious and some of them appeared to be introducing salivary juices onto the tents, but none was noted in the

process of gathering the glochids. In general, two to three individuals shared a tent in which to pupate; one tent was found containing five pupae. Under laboratory conditions, the duration of the pupal period was six to ten days. This insect is probably multivoltine as adults have been reared throughout the warmer months from various samples of fruit collected from late April to July. Oviposition was not noted, but since the ovipositor is not adapted for piercing, the eggs may simply be deposited on the surface of the fruit. The host plants are *Opuntia cañada*, *O. Engelmannii*, and *O. laevis*.

Acknowledgments are due to Dr. R. H. Foote, U. S. National Museum, for his generous assistance and to Dr. W. L. Nutting, University of Arizona, for his helpful suggestions.

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SCIENTIFIC NOTE

***Andrena clarkella* in Colorado.**—In 1919 Sladen (Canadian Entomol., 51: 124) pointed out that a species of *Andrena* collected by him in Quebec Province was conspecific with examples of *A. clarkella* (Kirby) from Great Britain. The distribution of this Holarctic species in North America is given by Linsley (1951, in Hymenoptera of America north of Mexico) and Mitchell (1960, in Bees of the Eastern United States, I) as Alaska to Minnesota, Quebec, Maine, and New York. It has been described as uncommon throughout its range, and is an early species, Sladen recording it from willow-bloom 23 April at Ottawa.

On 3 May 1963, B. Vogel, C. J. McCoy, and I took a series of *clarkella*, many of them pollen-laden, from willow flowers at Eldora, Boulder County, Colorado, at an elevation of 9,000 feet. Sladen noted that Ottawa specimens of *clarkella* averaged smaller than British specimens, the average lengths of females being 13.33 and 14.00 mm respectively. This difference is accentuated in the Eldora series of 23 females, the lengths (measured to nearest 0.5 mm) ranging from 10.5 to 12.5, with a mode of 11.5 mm. On 8 May I took more specimens at *Salix* near Chambers Lake in Larimer County, Colorado, at 9,500 feet, with snow from the winter pack still banked around the willows.

Probably the reason that this large, conspicuous species—easily recognized among the North American *Andrena* (s.s.) by the clear orange-amber color of the hind tibia and of the scopa itself—has been overlooked in the Southern Rockies, a thousand miles south of its recorded range, is its early occurrence at high elevations.—U. N. LANHAM, *University of Colorado Museum, Boulder*.

SCIENTIFIC NOTE

A note on the identity of *Liparocephalus brevipennis* (Coleoptera : Staphylinidae).—I recently received from Trevor Kincaid two specimens of *Liparocephalus cordicollis* LeConte from Yachutat, Alaska, collected by him in 1899. In a review of the genus (1956, Trans. San Diego Soc. Nat. Hist., 12: 116), I pointed out that all records for that species from Alaska were in doubt because of the confusion surrounding the correct identity of *L. brevipennis* Mäklin, specimens which I believed to represent *brevipennis* being the only ones which I had seen from Alaska. The new record of *cordicollis* from near the type locality of *brevipennis* now casts new doubt as to which species was before Mäklin when he described the latter. A reexamination of Mäklin's type will be necessary to solve the problem. Should Mäklin's type prove to be *cordicollis*, the species identified by me as *brevipennis* will require another name. It seems best to leave the matter in abeyance, and to use the two names in the sense which I applied them until the type of *brevipennis* can be reexamined.—IAN MOORE, *San Diego Museum of Natural History*.

BOOK NOTICE

A CATALOGUE OF THE NEARCTIC CHALCIDOIDEA (Insecta: Hymenoptera). By Oswald Peck. The Canadian Entomologist, Supplement 30: 1092 pp. 1 May 1963. For sale at Ottawa, Ontario, price \$10.00 (which includes the current volume of the Canadian Entomologist and certain Memoirs).

Despite Dr. Peck's warning that ". . . this catalogue, like others, is not an authoritative accumulation of facts but an integration of fact, opinion and error . . . the catalogue is only a guide and cannot present all the data; therefore it is wise to consult the original references, whenever possible," it is hard to see how the work could have been better done. It is the first full catalogue for the superfamily, with bibliographies for the species, generic and specific synonymies, and summaries of distribution and hosts, in 65 years! The main entries cover the period up to 1 May 1959, though many subsequent additions and changes are included.

Following a short introduction there is a 7-page systematic arrangement of the Nearctic genera of Chalcidoidea, then the systematic catalogue of species. Pages 896–917 include lists of unplaced genera and species, Nearctic species transferred from Chalcidoidea, unverified Nearctic records of exotic species, and unplaced *nomina nuda*. Pages 918–995 comprise a systematic list of hosts of Nearctic species, in the Animal Kingdom (918–989) and Plant Kingdom. Finally, there is a Host-Parasite Index preceding the General Index. Page 1092 is a list of addenda, while the inside front cover lists all the *Canadian Entomologist* Supplements, with their true dates of publication; subsequent issues will appear under the new title "Memoirs of the Entomological Society of Canada."—HUGH B. LEECH, *California Academy of Sciences, San Francisco*.

***Liriomyza dianthi*, a New Synonym of *L. langei* Frick**

(Diptera : Agromyzidae)

KENNETH E. FRICK

Entomology Research Division, Agric. Res. Serv., U.S.D.A.

The first record of an agromyzid leaf miner on *Dianthus* spp. in North America was in 1956 when leaf mines were first noticed on carnations at Redwood City, about 20 miles southeast of San Francisco, California. The insect was described as *Liriomyza dianthi* by Frick (1958) from 16 of the 19 specimens reared from larvae before chemical-control measures were applied.

Since 1958, personnel of the California State Department of Agriculture have continued to collect and rear out flies from larvae mining the leaves of *Dianthus caryophyllus* L. and *D. barbatus* L. By the end of 1960 an additional 38 females and 16 males had been reared. These specimens were made available for study through the kindness of M. S. Wasbauer, Systematic Entomologist, California State Bureau of Entomology, Sacramento. There were 15 from Berkeley (25 miles north of Redwood City), 36 from Richmond (30 miles north), 1 from Auburn (120 miles northeast), and 2 from the Los Angeles area. In addition, several larvae from Sacramento (85 miles northeast of Redwood City) were included.

One of the characters used to separate *dianthi* from *L. langei* Frick (1951) was the condition of the posterior crossvein (m-m) in the wing. Difficulties in using this character made it necessary to review the status of the two segregates. Eighteen of the 19 specimens available at the time of the description of *dianthi* had both wings present and each wing had the crossvein complete. The additional specimens reared from *Dianthus* were checked for the condition of the vein. Its presence or absence compares very favorably with the condition found in 1,000 specimens of *langei* (Table 1). In this longer series the reduction of the crossvein plus the intergradation of colors with those of *langei* made it apparent that only a single species is involved.

The holotype male of *dianthi* is the darkest specimen and represents the extreme variation of darkness for *langei* (Frick, 1958, figs. 1 and 3). The allotype female and three paratypes are nearly as dark. Later, these color extremes were the only characters used for separating the two species (Frick, 1959). By that time, the shape of the heads, compared and figured in 1958, was considered to be due to differences in maturity at death and therefore in shrinkage following death.

Table 1. Conditions of the posterior (m-m) crossvein in *L. langei* reared from many host plants compared with specimens reared from *Dianthus*.

Species	No. of Specimens	Condition of the Crossvein Expressed in per cent					
		Both Present	1 present 1 vestigial	1 present 1 absent	Both Vestigial	1 vestigial 1 absent	Both Absent
<i>langei</i>	1,000	81.7	5.7	1.0	6.8	2.9	1.9
" <i>dianthi</i> "	71	77.4	8.4	1.4	4.2	7.0	1.4

Four terminalia were dissected from 2 male paratypes of *dianthi*, 1 male reared from *Dianthus* in 1960 at Richmond, and 1 topotypical male paratype of *langei*. All were identical and characterized by the extremely long curved tooth on the surstylus. This tooth is subequal in length to the greatest width of the surstylus. In the larvae the numbers of bulbs on the spiracles overlap. With *langei* 6 bulbs occur on the anterior and 7 or 8 on the posterior spiracles and in *dianthi*, 5 to 7 on the anterior and 8 or 9 on the posterior spiracles.

Therefore, based upon the studies just outlined, the following synonymy is proposed:

Liriomyza langei Frick, 1951. Pan-Pac. Entomol., 27 (2): 81-88.

Liriomyza dianthi Frick, 1958. Proc. Entomol. Soc. Washington, 60 (1): 1-5. New synonymy.

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 1958. *Liriomyza dianthi* n. sp., a new pest of carnations in California. Proc. Entomol. Soc. Washington, 60 (1): 1-5.
 1959. Synopsis of the species of agromyzid leaf miners described from North America. Proc. U. S. Natl. Mus., 108: 347-465.

BOOK NOTICE

INSECT PATHOLOGY. AN ADVANCED TREATISE. Volume I. Edited by Edward A. Steinhaus, with seventeen contributing authors. xviii + 661 pp., 71 figs., extensive bibliographies. Academic Press, New York and London. Price \$19.00.

Volume I deals with noninfectious diseases, microbiota of healthy insects, epizootiology, immunity, physiopathology, predisposition to disease, virus diseases, and rickettsial diseases.—HUGH B. LEECH, *California Academy of Sciences, San Francisco*.

Identification of *Culex* (*Culex*) Larvae in California

(Diptera : Culicidae)

CHARLES M. MYERS

*California State Department of Public Health,
Bureau of Vector Control, Fresno*

The available keys to fourth instar larvae of the six members of the subgenus *Culex* in California were devised by Freeborn and Bohart (1951) and Carpenter and LaCasse (1955). Since difficulty may be encountered in identifying certain larvae with the keys, a new key is proposed incorporating some characters which have not been used previously.

A discussion of some characters in use in available keys, a table of some characters of taxonomic importance, and a key derived from such characters are presented. The species discussed are: *Culex erythrothorax* Dyar, *C. peus* Speiser, *C. pipiens pipiens* Linnaeus, *C. pipiens quinquefasciatus* Say, *C. restuans* Theobald, *C. tarsalis* Coquillett, and *C. thriambus* Dyar.

MATERIALS AND METHODS

All larvae were mounted in balsam and examined at $200\times$ magnification with a Zeiss phase-contrast binocular microscope. The following characters were examined: the number of branches of each seta, the number and position of siphonal tufts, the relative positions of dorsal microsetae of the saddle, and the presence of spines on the apodeme of the siphon (the "stirrup-shaped piece" of Breland, 1952 and 1957).

Specimens from outside of California were included to evaluate the variability of certain characters. The number of larvae examined from each of the following locations is noted in parentheses:

- C. erythrothorax*: Fresno Co., Calif. (5); Merced Co., Calif. (40); Ventura Co., Calif. (2); Churchill Co., Nev. (6).
- C. peus*: Fresno Co., Calif. (10); Kings Co., Calif. (20); Madera Co., Calif. (5); Mariposa Co., Calif. (30).
- C. p. pipiens* and *C. p. quinquefasciatus*: Fresno Co., Calif. (5); Kern Co., Calif. (20); Kings Co., Calif. (20); San Joaquin Co., Calif. (2); Ramsay Co., Minn. (18); Greenville, Miss. (17); Harrison Co., Texas (1).
- C. restuans*: Fresno Co., Calif. (10); Atlanta, Ga. (5); Douglas Co., Kan. (27); Lake Co., Minn. (8); Ramsay Co., Minn. (25); Greenville, Miss. (22); Obion Co., Tenn. (1).
- C. tarsalis*: Calaveras Co., Calif. (1); Fresno Co., Calif. (19); Kern Co., Calif. (18); Kings Co., Calif. (5); Madera Co., Calif. (10); Siskiyou Co., Calif.

(1); Tulare Co., Calif. (9); Douglas Co., Kan. (44); Ramsay Co., Minn. (6).

C. thriambus: Fresno Co., Calif. (31); Madera Co., Calif. (20).

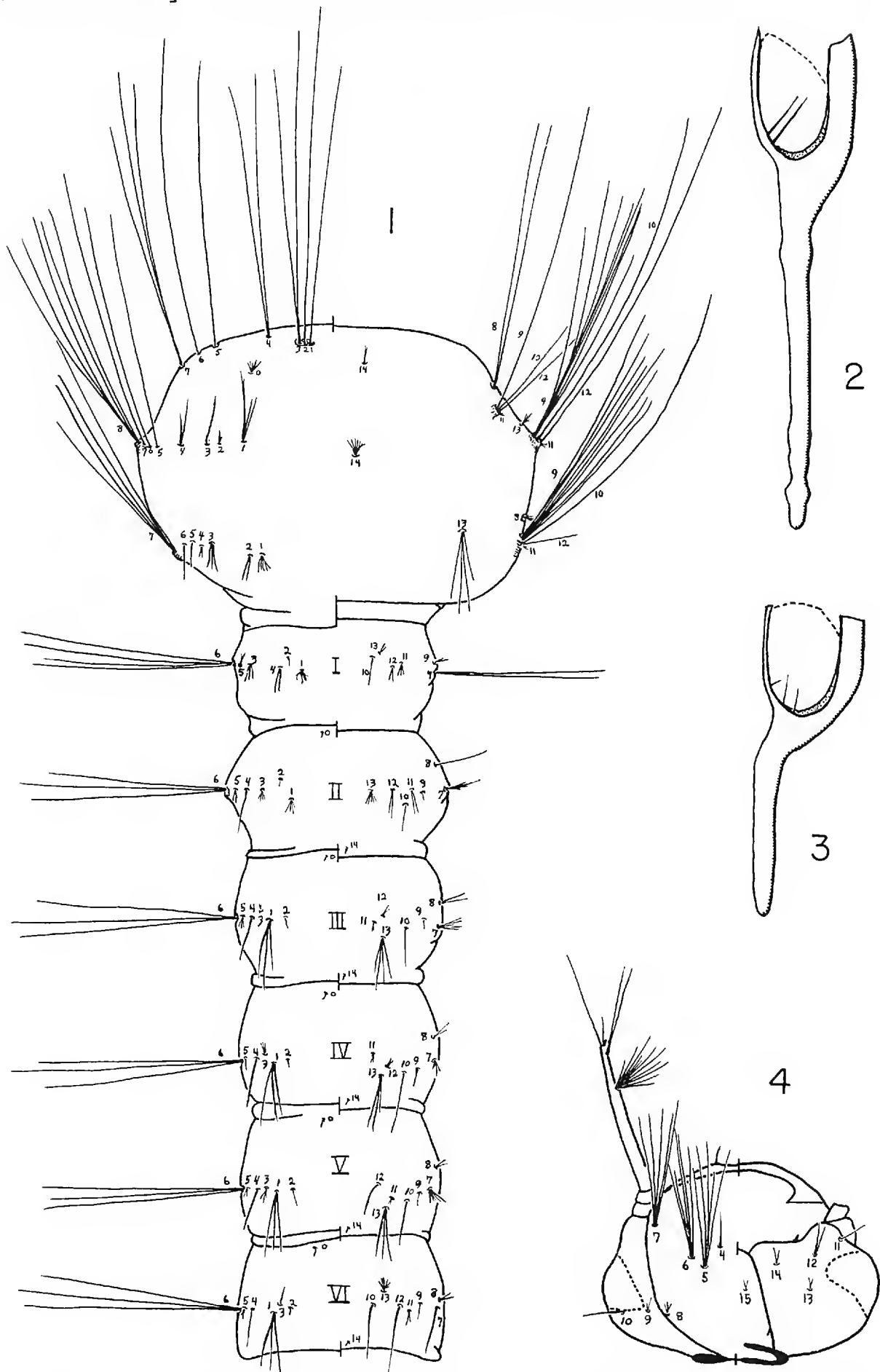
RESULTS

The range of variability of characters of taxonomic importance is given in Table 1. Figs. 1, 4, and 5 represent a *Culex tarsalis* larva; the chaetotaxy of Barr and Myers (1962) is used.

In all of the species examined the position and number of siphonal tufts varied, and the dorsal microsetae of the saddle were larger on the apex than on the middle of the saddle. Spines on the apodeme of the siphon were found on all specimens of *C. peus* and *C. thriambus* (Figs. 2 and 3). Spines were not found on this structure in any other species.

Table 1. Variability of setal branches and other taxonomic characters.

Segment	Hair No.	<i>C. erythrothorax</i>	<i>C. peus</i>	<i>C. pipiens</i>	<i>C. tarsalis</i>	<i>C. thriambus</i>	<i>C. restuans</i>
Head	4	1	1	1	1	1	2-3
<i>Thorax</i>							
Pro	0	8-14	10-19	9-20	17-23	11-26	7-14
Pro	3	1	1	1	2	1	2
Pro	14	1	1	1	2	1	1
Meso	1	3-4	3-5	1	3-5	3-4	2-3
Meta	2	1-2	1-3	1-2	2-3	2-2	1-1
<i>Abdomen</i>							
I	1	7-11	6-9	2-5	6-10	5-10	3-5
I	3	1-2	1-2	1	2-4	2	1
II	1	3-4	3-5	1-2	3-4	2-4	1-2
II	3	3-5	4-7	2-5	5-10	5-6	4-5
II	7	2-5	4-7	2-4	5-7	4-6	2-4
III	1	4-5	3-5	1-2	3-4	2-3	1-2
III	6	2	2-3	2	3	2	1
III	8	2	1	1	1-2	1	1
IV	1	3-5	3-4	1-2	3-5	2-3	1
IV	5	1-2	3-4	2-4	1-4	1-3	1-2
IV	6	2	2-3	2	3	2	1
IV	8	2	1	1	2-3	1	1
V	1	3-4	3-4	1-2	3-4	2-3	1
V	3	2-4	5-8	2-4	4-7	3-5	1
VIII	Comb Scales	65-95	28-44	35-48	52-78	45-57	32-47
X	IHDT	2-3	2-3	2	2-4	2-3	1
Siphon	Spines on apodeme	absent	present	absent	absent	present	absent



Figs. 1-4. Structures of *Culex* larvae. 1, Thorax and first six abdominal segments of fourth instar *Culex tarsalis* larva (dorsal aspect on left, ventral on right). 2, Siphonal apodeme of *Culex thriambus*. 3, Siphonal apodeme of *Culex peus*. 4, Head of fourth instar *Culex tarsalis* larva (dorsal aspect on left, ventral on right).

A key based on some characters from Table 1 has proved satisfactory for identifying all larvae of the subgenus *Culex* in California examined by the author. Table 1 contains information on the variability of additional characters studied which may be useful for identifying certain larvae which cannot be readily identified with the key.

KEY TO FOURTH INSTAR LARVAE

- 1a. Lower head hair with 3 or more branches; upper head hair with 4 or more branches Subgenus *Culex*, 2
- b. Lower head hair single or double; upper head hair with 3 or fewer branches Subgenera *Neoculex* and *Melanoconion*
- 2a. Siphonal tufts with two or more branches 4
- b. Siphonal tufts mostly single 3
- 3a. Antennal tuft inserted at apical $\frac{1}{3}$ of shaft; inner hair of dorsal tuft with 2 or more branches; IV-1 and V-1 with 2 or 3 branches; spines on apodeme of siphon *thriambus*
- b. Antennal tuft inserted at or before middle of shaft; inner hair of dorsal tuft usually single; IV-1 and V-1 usually single; apodeme of siphon without spines *restuans*
- 4a. III-1, IV-1, and V-1 with 3 or more branches; mesothoracic-1 usually with 3 or more branches, rarely double; II-1 usually with 3 or more branches; I-1 usually with 6 or more branches 5
- b. III-1, IV-1, and V-1 usually single or double; mesothoracic-1 usually single, rarely double; II-1 usually single or double; I-1 usually with less than 6 branches *pipiens*
- 5a. Basal siphonal tuft usually inserted at apex of pecten; more than 50 comb scales per patch; apodeme of siphon without spines 6
- b. Basal siphonal tuft frequently inserted within pecten; usually 28-44 comb scales per patch; apodeme of siphon with 1 or more spines *peus*
- 6a. III-6 and IV-6 usually double; usually 1 or 2 pairs of siphonal tufts lateral of ventral tufts; Pro-3 usually single *erythrothorax*
- b. III-6 and IV-6 usually triple; siphonal tufts frequently all ventral; Pro-3 usually double *tarsalis*

DISCUSSION

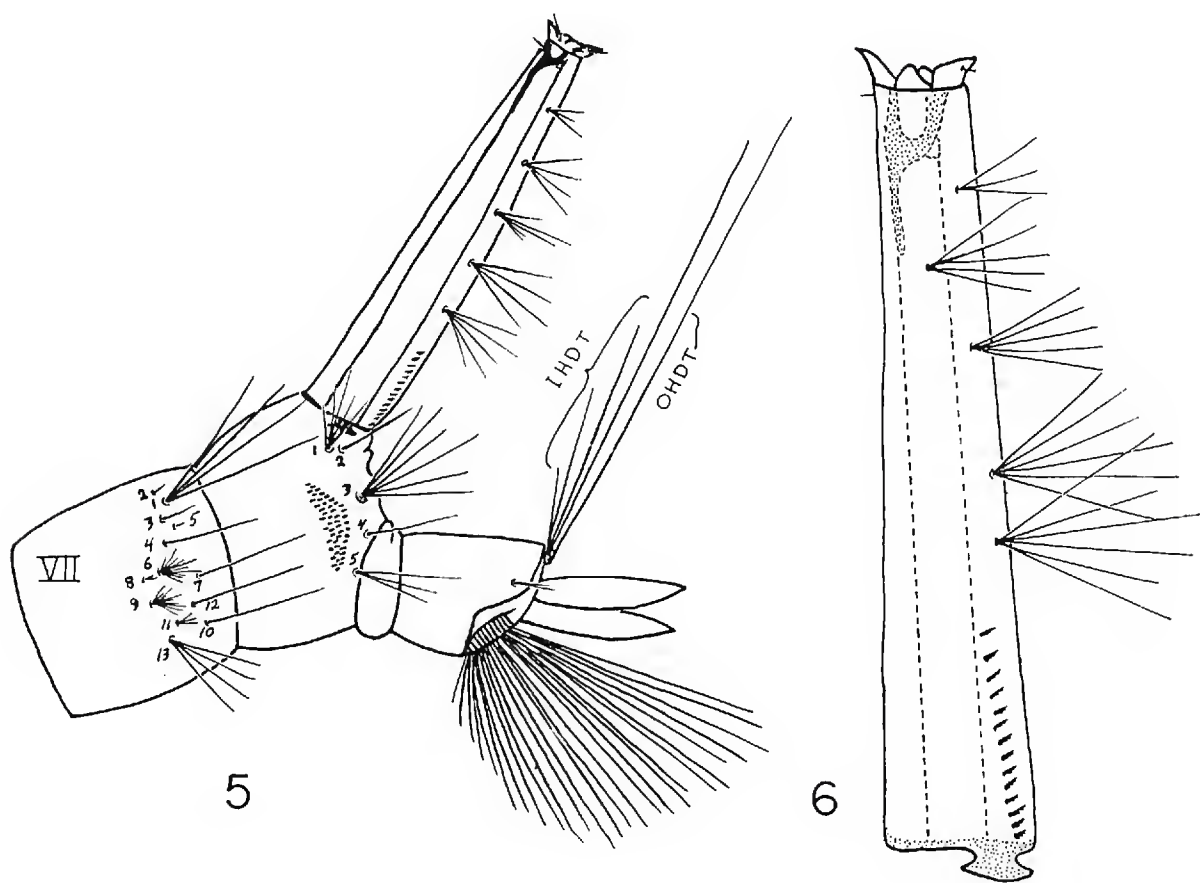
Most descriptions and keys to larvae of *Culex* species have placed emphasis on the characters of the anal segment. Considerable overlapping variation in such characters was apparent when many individuals of several species were examined. The numbers and positions of the siphonal tufts were the most variable characters.

Larvae of *C. restuans* and *C. thriambus* may be separated from the other Californian members of the subgenus *Culex* by their usually unbranched subapical siphonal tufts. The apical siphonal tuft is usually branched in both species.

C. erythrothorax normally has five pairs of siphonal tufts, and both subapical pairs are lateral. In all the specimens examined there were at least 60 comb scales on each side of segment VIII. This species may be confused with *C. peus*, which often has the same siphonal tuft pattern.

C. peus shows great variation in the pattern and number of siphonal tufts (Breland, 1957). The lateral setae of abdominal segments III and IV (III-6 and IV-6) have often been described as triple. The author found that these setae were double in about one-fourth of the specimens examined. The dorsal microsetae on the saddle of all *Culex* (*Culex*) larvae were larger at the apex than at the middle of the saddle. The microsetae, however, are usually more obvious in *C. peus*, and this character has been used to separate *C. peus* from other *Culex* larvae. Furthermore, *C. peus* may be distinguished from other species with multiple branched siphonal tufts by the spines on the apodeme of the siphon. It is necessary to clear specimens to demonstrate the presence of spines on the apodeme.

Of the species with branched siphonal tufts, *C. pipiens* was the only species studied with III-1, IV-1, and V-1 all single or double. A study



EXPLANATION OF FIGURES

Fig. 5. Lateral aspect of seventh abdominal and anal segments of fourth instar *Culex tarsalis* larva. Fig. 6. Siphon of fourth instar *Culex tarsalis* larva with sub-apical tuft out of line.

of the larvae of *C. pipiens* in California indicated that they vary in the same manner as the specimens from Texas studied by Breland (1957). Many larvae of *C. pipiens* had either five tufts on one side and four on the other, or five tufts on both sides of the siphon. This pattern of siphonal tufts has been noted for *C. peus* by Breland (1957).

MacMillan (1958) studied the siphonal index, number of comb scales, branching of pentad hairs (VIII-1, VIII-3, and VIII-5), and the branching of the siphonal tufts in *C. p. pipiens* and *C. p. quinquefasciatus*. He found that although the comparative number of branches of the basal siphonal tufts was of some statistical value for separating populations, none of the characters studied was of value in separating individuals of these two subspecies. In the present study the author was unable to separate *C. p. quinquefasciatus* larvae from California, from *C. p. pipiens* larvae from Minnesota.

C. tarsalis is easily separated from other species with branched siphonal tufts; Pro-3 is double, and the siphonal tufts usually lie in a straight line. Several of the *C. tarsalis* larvae examined had either one or both of the subapical siphonal tufts placed laterally (Fig. 6). This was also observed by White (1956). Similar variations have been found in *C. peus* (Breland, 1957).

ACKNOWLEDGMENT

The author wishes to express his thanks to Dr. A. R. Barr of the Bureau of Vector Control for his encouragement and advice and for providing many of the specimens studied.

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Observations on the Siricid Parasite *Ibalia ensiger*

(Hymenoptera : Ibalidae)

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Members of the genus *Ibalia* are important endoparasites of wood wasps (Siricidae) in some parts of the world (Chrystal, 1930; Rawlings, 1953), but there are only a few records of their occurrence in California. Flanders (1962) observed *Ibalia* parasitizing siricids breeding in Monterey cypress at Berkeley. The files of the Pacific Southwest Forest and Range Experiment Station contain records of *Ibalia ensiger* Norton reared out of other kinds of siricid-infested material from other California localities. The few records suggest that these parasites are not abundant in the State, but recent observations show that this is not always the case.

On 27 September 1962, a mass flight of *Ibalia ensiger* was observed around siricid-infested incense-cedar lumber air drying in a mill yard near Foresthill. Many of the wood wasps, mainly *Sirex areolatus* (Cresson), also were flying, having just emerged from the lumber. Great numbers of both insects were active between 10 a.m. and noon, during a period when the sky was clear and the temperature about 78° F. The flights ceased, however, by 1 p.m. when the sky became overcast and the temperature dropped to 60° F.

None of the parasites was seen in the act of emerging from the lumber. But numerous emergence holes too small for siricids in both freshly cut and older lumber indicate that both the parasite and its host came from the same material.

Ibalia ensiger, like its host, probably has a 1- to 3-year life cycle. The history of the material observed at Foresthill suggests that it can develop in 2 years. The lumber in this case came from trees on the Volcano Burn which were killed by fire in 1960. Part of the trees were logged the same year and milled during the winter of 1960-1961; part were logged in May 1962 and milled in August. Some of the lumber therefore was infested with siricids for 2 years. Since no adult parasites were found during extensive collections on the Volcano Burn the year after the fire, it is inferred that they also took 2 years to develop.

The host of this parasite belongs to a group that contributes heavily to the deterioration of fire-killed trees. Damage by these insects has become important in California because of the numerous timber fires

in recent years, and consequent large amounts of siricid-infested lumber reaching the market (Middlekauff, 1962). The occurrence of *Ibalia ensiger* in such large numbers as were observed at Foresthill suggests that this insect may be a more important agent in controlling its host than has been thought.

Chrystal (1930) has reported that a closely related species, *Ibalia leucospoides* Hochenwarth, is an important natural enemy of *Sirex cyaneus* Fabricius in England. *I. leucospoides* has been imported extensively in New Zealand to control *Sirex noctilio* (Fabricius) (Rawlings, 1953). *I. ensiger* may be a potentially useful parasite for biological control of these insects and should be more carefully studied.

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RECENT LITERATURE

The following titles are from the *University of Utah Biological Series* (University of Utah, Salt Lake City); each is a separately published item.—HUGH B. LEECH, *California Academy of Sciences, San Francisco*.

- AN IDENTIFICATION GUIDE TO THE MOSQUITOES OF UTAH. By Lewis T. Nelsen and Don M. Rees. Vol. 12, no. 3, vi + 58 pp., incl. a map and 57 figs., many compound. June 1961. \$2.00.
- CHILOPODS SECURED BY THE ROYAL SOCIETY EXPEDITION TO SOUTHERN CHILE IN 1958-59. By Ralph V. Chamberlin. Vol. 12, no. 4, vi + 24 pp., incl. 7 pls. 1 October 1962. \$1.50.
- THE TYPE LOCALITIES OF THE EPHEMEROPTERA OF NORTH AMERICA NORTH OF MEXICO. By George F. Edmunds, Jr. Vol. 12, no. 5, viii + 38 pp. 1 October 1962. \$1.75.
- DRAGONFLY NYMPHS OF UTAH (Odonata: Anisoptera). By R. Jean Musser. Vol. 12, no. 6, viii + 66 pp., incl. 5 pls. 1 October 1962. \$2.75.

**Observations on *Lomamyia latipennis*, with a Description
of the First Instar Larva**

(Neuroptera : Berothidae)

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Previously, *Lomamyia latipennis* Carpenter was recorded from only five specimens with localities ranging from Lytton, British Columbia, and Ormsby County, Nevada, to San Diego, California (Carpenter, 1940). During the early part of last summer, I made two relatively large collections of this berothid. The first collection was made on 24 and 25 June 1962 at Pelton Dam, Jefferson County, Oregon. Five adults (4♀ and 1♂) were taken at dusk by sweeping a single bush of *Ribes cereum* Dougl. Attempts to take the berothid at other times of the day on this bush were unsuccessful as were attempts on other bushes of the same species and of different species. One specimen died immediately, but four were kept alive for observation. Only one specimen survived more than a week. This was a female which laid two batches of eggs, the first on 25 June and the other between 4 and 6 July.

The second collection was made in the early evening of 4 July 1962 at Sagehen Creek Wildlife Station near Truckee, Nevada County, California. Three specimens (1♀ and 2♂♂) were taken on *Ceanothus velutinus* Dougl., two (1♀ and 1♂) on *Ribes cereum* Dougl., and one (a ♂) on *Artemisia tridentata* Nutt. Three males died by 8 July. The two females lived and laid eggs until 18 July and one male lived until 22 July.

OBSERVATIONS OF THE ADULTS

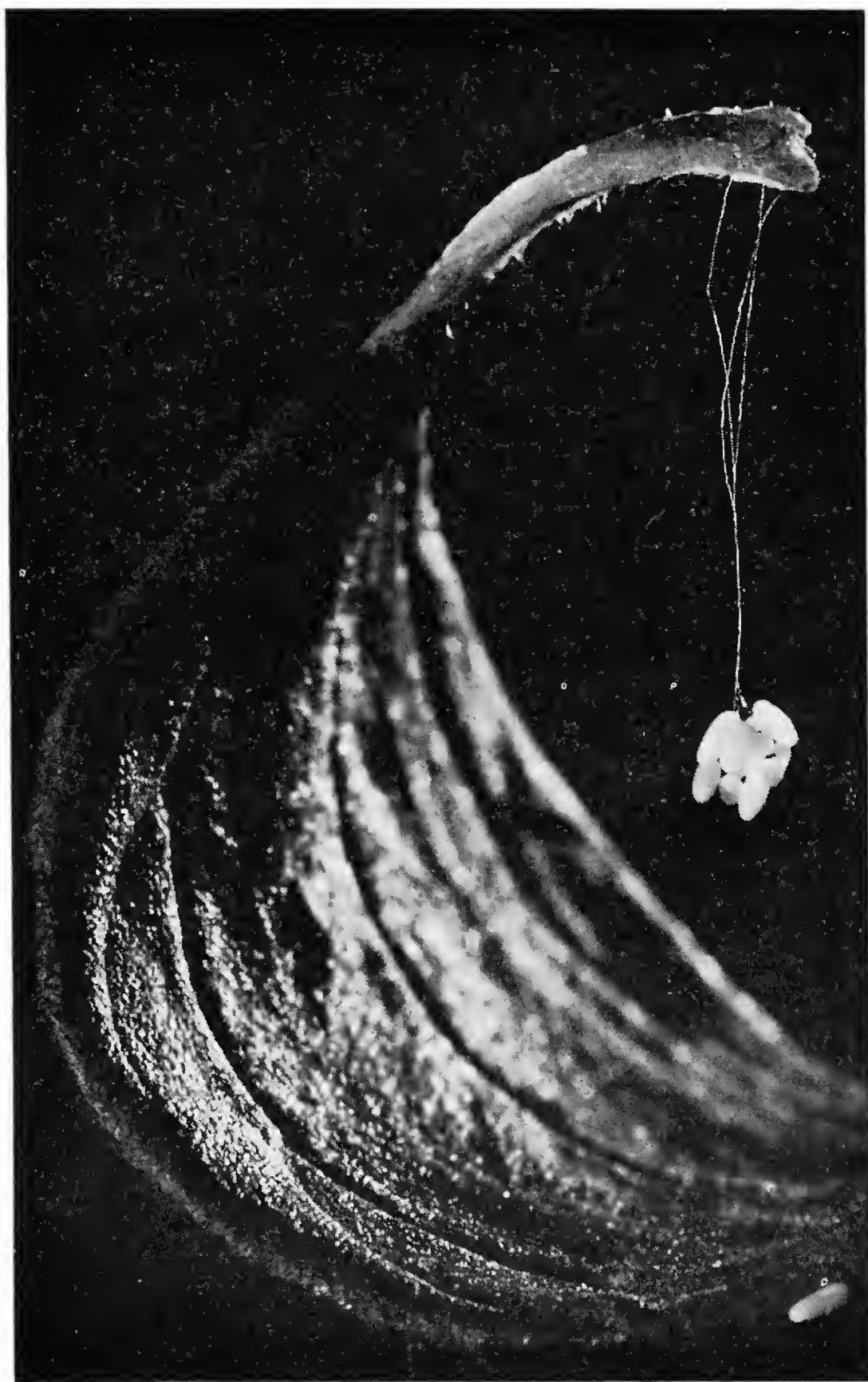
Although adult berothids can fly fairly well, they were usually inactive on the undersides of leaves or on the stems of plants. At rest the wings were held over the body, and the antennae often were held together and straight out from the head so that they appeared as a single structure.

Movements of these adults consisted of the following behaviors. The adults exhibited a peculiar habit of swaying from side to side. Occasionally they were seen to bend the abdomen forward ventrally to the mouth where the tip was apparently cleaned. Usually after feeding, the antennae and legs were cleaned by drawing them through the mouthparts. A solution of sugar and water was the only food offered to the adults. They readily accepted it.



EXPLANATION OF FIGURE

Fig. 1. *Lomamyia latipennis* Carpenter egg just before hatching ($\times 26$).



EXPLANATION OF FIGURE

Fig. 2. Cluster of *Lomamyia latipennis* Carpenter eggs ($\times 8$).

On one occasion, oviposition of a single unstalked egg was observed. This occurred immediately after the female had been transferred from one jar to another and, therefore, was probably not normal. First, a droplet of clear liquid was placed on a leaf as the adult walked forward. Then a single oval unstalked egg was deposited on the leaf in front of the droplet. The female continued walking forward during the whole procedure.

EGGS OF *LOMAMYIA OCCIDENTALIS*

Tillyard (1916) was the first to describe the stalked and transversely marked eggs of berothids (the Australian *Spermaphorella disseminata* Tillyard and *S. maculatissima* Tillyard). Smith (1923) described a single unstalked egg laid by *Lomamyia flavicornis* Walker which Gurney (1947) considered abnormal. Gurney (1947) reported the oviposition habits of a species of *Lomamyia* which was not further identified. He recorded the occurrence of a cluster of twelve eggs laid at the end of a single thin stalk, other clusters with fewer eggs, and single stalked or unstalked eggs. Thus, the oviposition habits of *L. latipennis* which I observed under laboratory conditions were very similar to those reported by Gurney. Four large clusters of eggs were laid by three females of this species. Other eggs were laid in small groups or singly on stalks or directly on the substrate.

The *L. latipennis* eggs were 0.6 mm long and 0.33 mm wide; the stalks were 6 mm long. The chorion had a honeycombed appearance. When first laid, the eggs were a dull white, but as the embryos developed within the eggs red bands of pigment could be seen through the chorion. Thus, the eggs had a red and white striped appearance just before hatching (Fig. 1).

As shown in Fig. 2, the cluster of eggs was held, in this case, by several extremely thin stalks. A fourth was present, but it is not visible in the picture. These stalks were very flexible and therefore they did not support the eggs as the stalks of Chrysopidae do. They served instead to hang the eggs from some object. As the eggs grew older, they fell from the cluster to the soil where they hatched. The incubation period ranged from eight to eleven days in one group to fifteen and sixteen days in another, probably due to a difference in temperature.

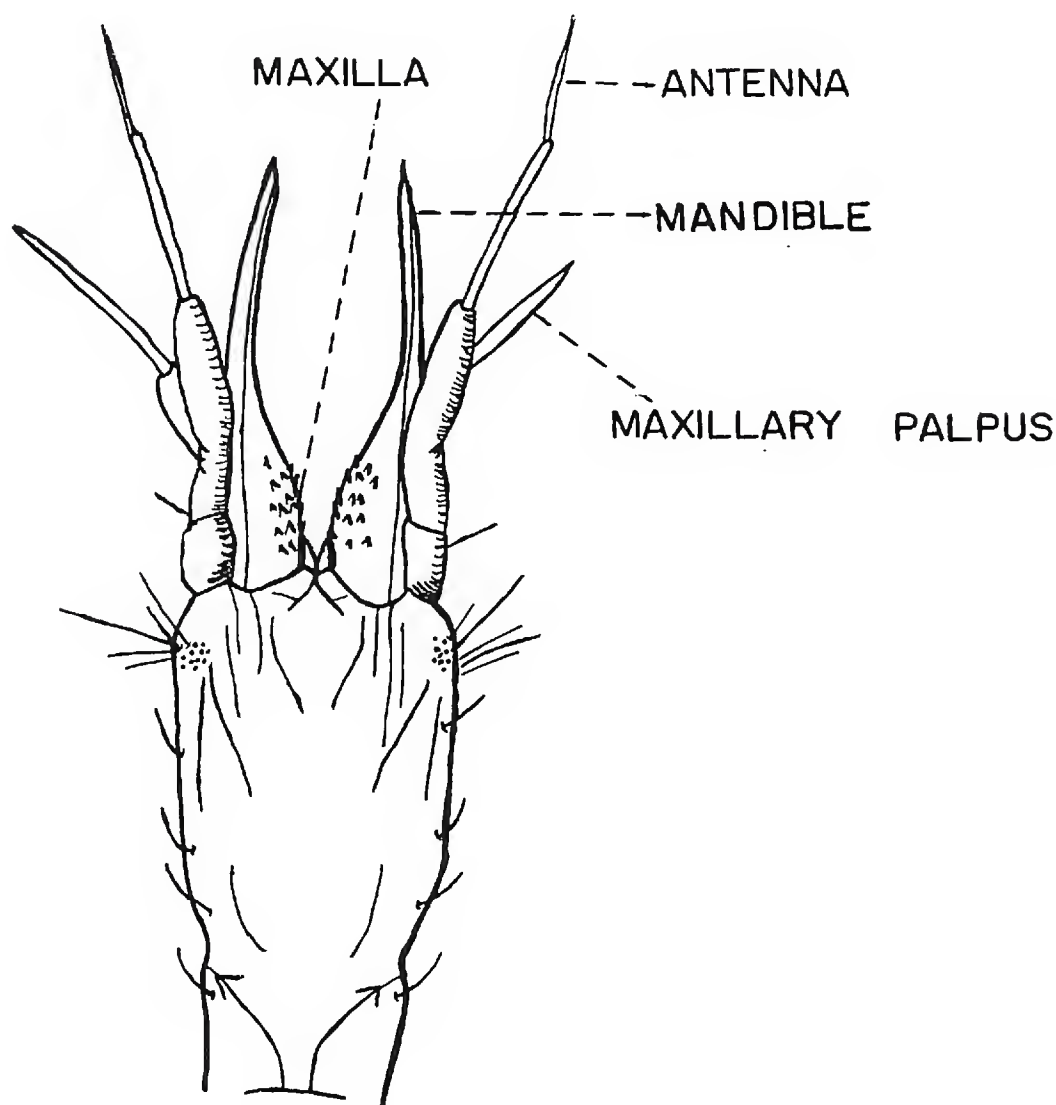
LARVAE

The larvae were frequently active, but they often hid beneath bits of leaves or debris. They moved rapidly and without the use of an anal sucker as does *Spermophorella* (Tillyard, 1916). Small living arthro-

Pods from soil samples as well as ant and scolytid larvae were offered to the berothid larvae. All died in the first instar within ten days. It was later learned that berothid larvae had been collected in logs containing termites where they were presumably predaceous on the termites (Gurney, 1947).

A second trip was taken to the Sagehen site on 4 August 1962 in an attempt to locate larvae. Beating and sweeping the plants from which the original collections were made and other bushes and trees in the area yielded no berothids. Soil samples from beneath the same plants were taken on 15 July by M. E. Irwin of the University of California at Davis and on the second trip by myself. These were run through a Berlese funnel, but no larvae of the berothid were found.

Gurney in 1947 described the first instar and the fully developed larva of an unidentified species of *Lomamyia*. The first instar larva of



EXPLANATION OF FIGURE

Fig. 3. Head of first instar *Lomamyia latipennis* Carpenter larva.

L. latipennis is similar to the description given by Gurney except in coloration. However, he did not describe or figure the chaetotaxy.

Head and legs of *L. latipennis* hyaline brown. Thoracic and abdominal tergites with transverse red and yellow bands as follows: pronotum with median red marking and with rounded lateral yellow markings which extend to end of thorax; mesonotum and metanotum with median red markings (wider than that of pronotum), adjacent yellow marks and with more lateral red markings; abdominal segments (except last two) red with posterolateral yellow markings; ninth segment reddish with median yellow marking; tenth segment clear. Ventral surface yellow to opaque. Head with nine pairs of setae as shown in Fig. 1: two setae extending laterally from maxillae; one pair as long as one-half width of head inserted immediately laterad to eyes; two other pairs inserted ventrad to second and about two-thirds length of second pair; fifth pair, about one-half length of second, inserted immediately anterior to eyes; sixth pair about as long as second, inserted proximal to eyes; other three pairs, about two-thirds length of second pair, first of these inserted posterior to and ventral to eyes about one-half distance down head; second inserted posterior to and slightly dorsal to first; third posterior to and slightly dorsal to second. Cervix with a pair of lateral setae, as long as posterior pairs on head. Prothorax with two pairs of lateral setae anterior to legs; forecoxae with pair of posterior setae and pair of anterior setae; mid and hind coxae with two pairs of anterior and two pairs of posterior setae extending beyond end of coxae; forefemora with pair of posterior and pair of anterior setae; mid and hind femora each with an anterior pair of setae, none extending beyond tips of femora. Abdominal segments with setae extending from posterolateral margins of venter, some almost as long as segment. Last two abdominal segments with several pairs of long setae and several pairs of shorter setae.

ACKNOWLEDGMENTS

I wish to thank Dr. J. W. MacSwain and Mrs. Celeste Green of the University of California, Dr. J. A. Powell of the California Insect Survey, Dr. C. D. MacNeill of the California Academy of Sciences, and E. G. MacLeod of Harvard for their help in this study. I also would like to express special thanks to A. A. Blaker of the University of California Scientific Photographic Laboratory for the excellent photographs of the eggs.

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**Notes on the Morphology and Laboratory Rearing of
*Phlebotomus vexator occidentis***

(Diptera : Psychodidae)

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Mangabeira and Galindo (1944) first reported phlebotomine gnats from California and described one new species, *P. stewarti*. In addition, they considered seven male and five female specimens identical with topotypes of *P. vexator* Coquillett and described and illustrated certain features of the adults. Upon subsequent examination of these Californian *P. vexator* specimens, Fairchild and Hertig (1957) found minor but constant differences from the originally described eastern *P. vexator* and therefore assigned the subspecific name *P. vexator occidentis* to the material collected in California.

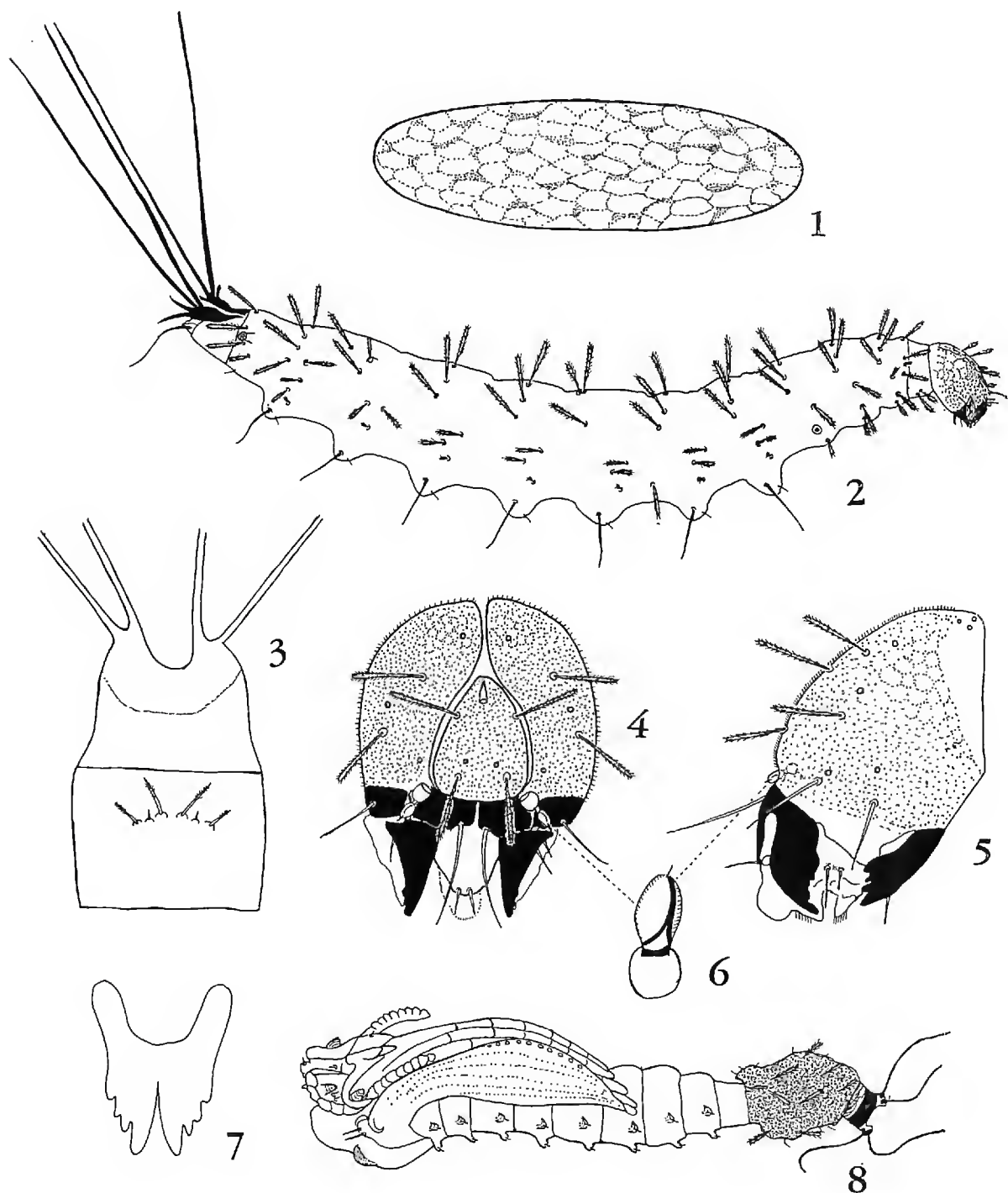
Based on relatively few collections it appears that this subspecies may be widespread along the western coast of the United States. It now has been collected either in light traps or from the burrows of *Citellus beecheyi* (Richardson) in Alameda, Contra Costa, Marin, Modoc, Mono, Ventura, San Luis Obispo, and San Mateo Counties, California (Mangabeira and Galindo, 1944; Fairchild and Hertig, 1957; and by the authors), and from mammalian burrows in eastern Washington (Fairchild and Harwood, 1961).

Although nine species and one subspecies of *Phlebotomus* are known from the United States (Coquillett, 1907; Dyar, 1929; Hall, 1936; Dampf, 1938; Dampf, 1944; Mangabeira and Galindo, 1944; Addis, 1945; Fairchild and Hertig, 1957; Fairchild and Harwood, 1961) the immature stages of only two have been described. Lindquist (1936) described and illustrated the egg and included a generalized illustration of the fourth-instar larva of *P. diabolicus* Hall, and Addis (1945) illustrated the egg, fourth-instar larva, and pupa of *P. anthophorus* Addis. As we were able to rear a small number of *P. vexator occidentis* through one complete generation in the laboratory, we provide herein the first complete description of all stages of the subspecies as well as notes on rearing techniques.

REARING TECHNIQUES AND NOTES ON DEVELOPMENT

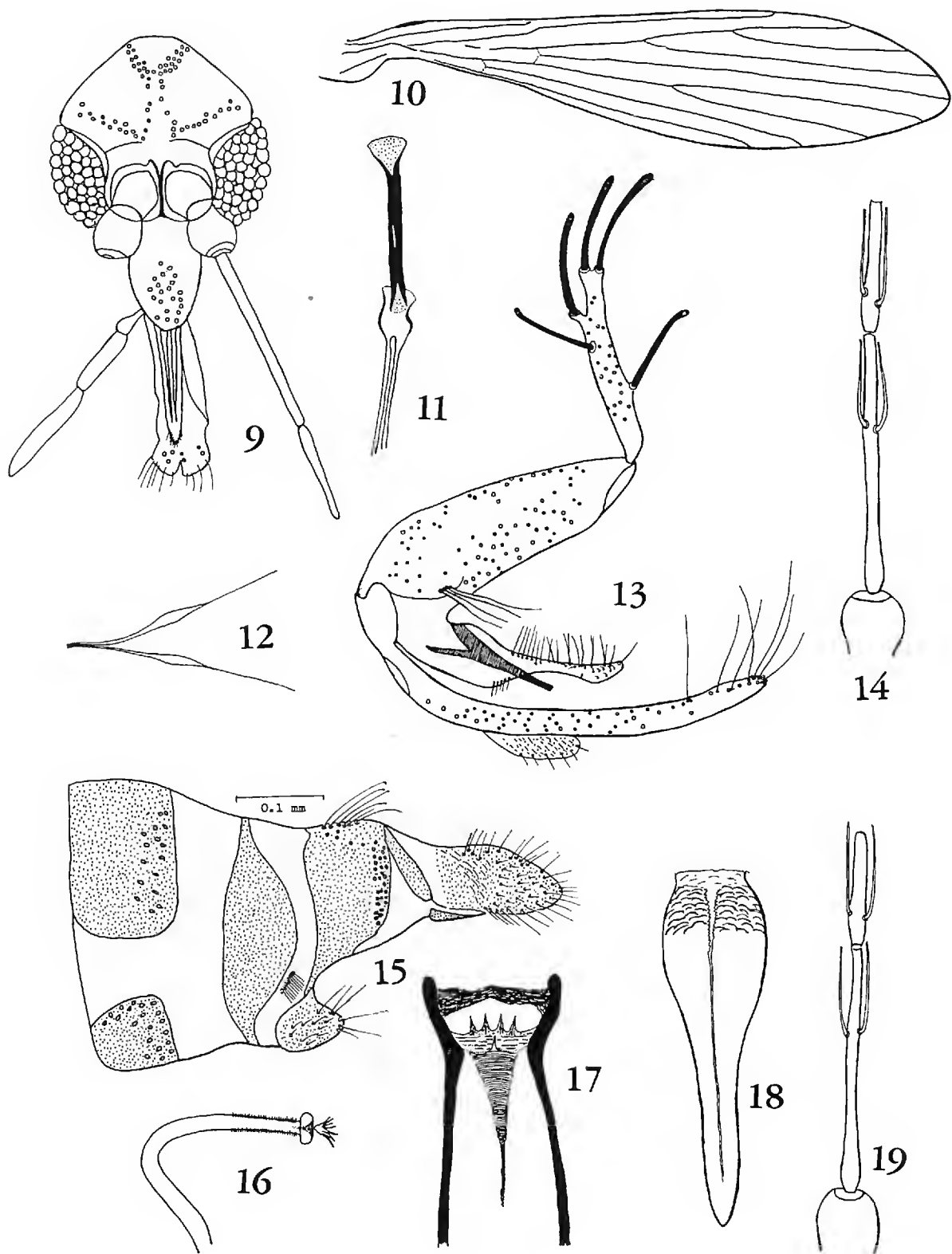
The initial laboratory stock was derived from one gravid female trapped at dusk as she was leaving a *Citellus beecheyi* burrow in Marin County. This female scattered 20 eggs singly on the surface of moistened plaster of paris lining the bottom of a vial. The eggs were then pipetted

and transferred in distilled water to a thick layer of plaster of paris lining the bottom of a small earthenware flower pot. Sterilized, fragmented hamster feces were introduced as a larval rearing medium. All stages were held at 25° C, and the plaster of paris was constantly kept in touch with water-saturated towels. The incubation period was 10–12



EXPLANATION OF FIGURES

Figs. 1–8, immature stages of *Phlebotomus vexator occidentis* from California. 1, egg; 2–7, fourth-instar larva; 3, venter of 8th and 9th abdominal segments; 4, head in anterior view; 5, head in side view; 6, antenna greatly enlarged; 7, hypostome enlarged; 8, pupa (pupal exuviae).



EXPLANATION OF FIGURES

Figs. 9-19, adult stage. 9, male head; 10, male wing; 11, genital pump; 12, terminal portion of genital filaments; 13, male genitalia; 14, male 3rd and 4th antennal segments; 15, female terminal abdominal segments (extended); 16, head and body of spermatheca; 17, female cibarium; 18, female pharynx; 19, female 3rd and 4th antennal segments.

days. Larvae completed development in 21–23 days, and the duration of the pupal stage was 12–14 days. Although all of the eggs hatched, only nine larvae were reared to the adult stage. The others were killed and preserved at various stages of development. Pupae occurred in small groups in the rearing pot as the larvae showed a tendency to aggregate shortly before pupating.

The newly emerged adults (six males and three females) were kept in a cloth cage in the dark and were provided with moistened raisins as a source of carbohydrate. Suckling laboratory mice were rejected as hosts by the flies, but they engorged readily on a southern alligator lizard, *Gerrhonotus multicarinatus* Blainville. After engorgement their abdomens were so grossly distended that they appeared unable to fly when disturbed. One pair was observed in copula when the cage was removed from the dark the morning following engorgement. Transfer of the cage to the lighted laboratory room appeared to interrupt copulation; after about a minute the fully engorged female dragged the coupled male along behind her for a distance of several inches before the two disengaged. Thirteen days after the first mating was seen the engorged females were transferred and individually isolated in oviposition vials stocked with sterilized, fragmented hamster feces.

One female laid six eggs 20 days after engorgement and then died the same day with 60 additional eggs in her abdomen. A second female laid 12 eggs 25 days after engorgement and also died shortly after oviposition still retaining 25 additional eggs.¹ The third female died without ovipositing after becoming entangled in fungal mycelia growing on the feces in the vial. Thirteen days after oviposition the first and only larva hatched. The other 17 eggs were observed for an additional period of forty days after which they were removed and preserved.

The number of eggs developed by the laboratory-reared females fell within the range of that observed among wild-caught gravid females leaving *Citellus* burrows. Four such field-caught specimens upon dissection were found to contain 44, 49, 57, and 74 eggs.

DESCRIPTIONS

Mangabeira and Galindo (1944) provided extensive descriptions of the adult stage of *P. vexator occidentis* (as *P. vexator*) and illustrated various taxonomic features. We have examined nearly 100 specimens collected from four different localities in 1962 and our measurements (cited below) show a wide variation from those given by the above

¹ Subsequent laboratory studies of the same species and literature reports concerning other species indicate that for these females the time between blood engorgement and oviposition was unusually prolonged.

authors. Several illustrations of adult characters are therefore presented in order to supplement the description and to provide a comprehensive taxonomic treatment of all developmental stages.

Egg (Fig. 1).—Elongate with rounded ends, approximately $440 \times 130 \mu$; dark brown, reticulated chorion.

Larva.—The first-instar larva has only two caudal bristles whereas the other three instars possess four caudal bristles and more numerous fimbriated body setae than the first.

Fourth-instar larva (Figs. 2–7).—Length about 4 mm. Head with a dense covering of microtrichiae, and with a triangular dorsal plate bearing four fimbriated setae. Mandibles well sclerotized. Hypostome well sclerotized; form as illustrated in Fig. 7. No eye spots. Antennae and other structures as illustrated. Two pairs of lateral spiracles: one metathoracic and one on tubercles of the eighth segment. Six isolated setae on venter of the eighth segment; no other segment with similar setae. Seven pseudopods, each with two thread-like setae (170μ long), two small (14μ) stiff anteroventral setae, and six smaller setae on the ventrolateral margins.

Pupa.—Typical of the genus in that it retains the cast larval skin at the posterior end of the body. Length about 3.2 mm. The morphological characters of pupae containing developing adults are difficult to observe because of the presence of numerous groups of long, dense setae which obscure the cuticular architecture.

Pupal exuviae (Fig. 8).—Thorax and abdomen with numerous small Y- and U-shaped cuticular processes, among which are scattered a few tiny setae arising from round alveoli. A tubercle with two prominent setae (70μ long) at the base of each wing. Each abdominal segment with two tubercular protrusions each of which bears a small (8μ) terminal seta.

Male (Figs. 9–14; all measurements based on 10 specimens).—Head as shown in Fig. 9. Wing 1.900×2.070 mm long and 0.385×0.465 mm wide. Ascoids simple, almost extending to the distal end of their respective segments; paired on segments III–XV. Genital filaments four times as long as genital pump. Coxite 270 – 335μ long, and with an inner tuft of four long hair-like setae. Style approximately 190μ long, with five spines of which two are terminal and the other three spaced so that the antipenultimate is twice as far from the basal than from the penultimate. Lateral lobe about 370μ long and slightly curved upwards.

Female (Figs. 15–19; all measurements based on 10 specimens).—Wing generally longer than in male, 2.045 – 2.570 mm long and 0.465 – 0.610 mm wide. Ascoids slightly longer than in male. Spermathecae slender and of nearly uniform diameter along the entire length; fine cross striations near distal ends. Cibarium, pharynx, and posterior end of abdomen as illustrated.

ACKNOWLEDGMENTS

We wish to thank Dr. G. B. Fairchild, Gorgas Memorial Laboratory, Canal Zone, for confirming the identification of male and female specimens, as well as for suggestions for proper mounting technique.

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BOOK NOTICE

EXPERIMENTS IN GENETICS WITH DROSOPHILA. By Monroe W. Stickberger. John Wiley & Sons, Inc., 440 Park Avenue South, New York 16, N.Y. 1 June 1962. \$3.95.

This is a well planned, clearly printed, illustrated laboratory manual. After sections on *Drosophila* life cycle, preparation and maintenance of cultures, techniques in handling flies and conducting experiments, examination of wild-type and mutant flies, and statistical testing for experiments, there are 18 experiments and procedures. These include such things as monohybrid crosses, genotype competition in a population cage, localizing an unknown mutant, quantitative inheritance, preparation of salivary chromosomes, etc. There is also a chapter on the capture and identification of *Drosophila* species, and a key to the United States species of the genus. Appendices include descriptions of mutations, mutations listed according to affected parts, etc. The exposition is simple and lucid.—HUGH B. LEECH, *California Academy of Sciences, San Francisco*.

Japygidae of North America 10: The Genus *Ctenjapyx* (Diplura)

LESLIE M. SMITH

University of California, Davis

The genus *Ctenjapyx* was erected by Silvestri (1948) for a single female specimen from Sierra de San Lazaro, Baja California Sur, Mexico. This specimen was named *C. boneti* Silvestri. To date, no other specimens of this genus were known. Japygids frequently give rise to monsters or anomalies, and the fact that only one specimen was known, and no others appeared in the subsequent fourteen years, would suggest that Silvestri erected this genus for an anomaly. However, the author has recently received two additional specimens of this genus, representing a new species.

The genus *Ctenjapyx* is distinct from all other genera because it has two shallow cheek-pouches on either side of the head, and these pouches are covered by a dense row of stout setae. The position of this genus is obscure, but from the nature of the placoid sensillae¹ of the antennae, the reduction of the labial palpi, the form of the styli with a single mesad seta, the structure of the male setose sac, and the similar dentition of the arms of the forceps, it seems desirable to place this genus in the subfamily Provalljapyginae Smith. From the shape of the mandible, setal pattern of the pleural sclerites, setae at the apex of the femora, the labial palpi, and the setae in the male setose sac, this genus seems more closely related to *Nanojapyx* Smith, than to other genera in the Provalljapyginae.

Ctenjapyx parkeri L. Smith, new species

MALE.—*Head* with 12+12M dorsally, and a few m, distal lamina of lacinia pectinate with about 5 teeth, lacinia falciform without tooth or flange, galea with one external seta, thumb of galea retractile, sclerotized with three sclerotized, recurved projections, maxillary palpus with 8 setae, one of which, median, as long as palpal segment, or 2.7 times as long as stylus I, antenna with 26 segments, not tapered, segment 3 with 12 setae, ten of which arranged in a median whorl, terminal segment conical, as wide as long, with 8 placoid sensillae in two whorls, no posteroventral proliferation of setae on any antennal segments, trichobothria equal in length to longest setae on the same segment, labial palpus represented by a slight swelling with two long and two short setae, longest seta twice as long as stylus I, a shallow, dorsoventral groove on the head at either side of the mouth cavity, covered externally by a close row of 24 stout setae, in the bottom of each groove a band of about 250 small circular sensory pits in six close rows, a group of 10 similar sensory pits on the outer edge of each stipes of the maxillae.

¹ For definition of terms see: Smith, L. M., 1962, Japygidae of South America 3, Proc. Biol. Soc. Washington, 75: 274-275.

Thorax.—Pronotum 5+5M and 7+7m, mesonotum prescutum 1+1M and 2+2m, transverse apodeme absent, scutum 5+5M and a large pair of anteromedian m, metanotum setae as on mesonotum, mesocoxae with 3 large pinnate setae and a few microsetae, trochanter with 4 large pinnate setae and one microseta, dorsal apex of femur with 2 plumose and one simple seta all approximately the same length, calcar setae no larger than other large setae on the ventral apex of tibia, tarsi with 4 stout setae per ventral row, tarsal claws nearly equal, empodium absent.

Abdomen.—Tergite I prescutum 1+1M, scutum 3+3M and a pair of large anteromedian m, tergites II–VII 7+7M and anteromedian pair which do not decrease in size posteriorly, tergite VIII 5+5M dorsally, tergite IX 3+3M, tergite X between the carinae 2+2M and a posterior pair of large m, posterolateral angles of tergites I–VII rounded, pygidium broad and flat. Sternum I apotome 3+3M, sternite row A 3+3M, row B 2+2M, row C 2+2M, and row D 4+4M, antecedent setae none, median subcoxal organ none, lateral subcoxal organs occupying nine-tenths of the distance between the styli, glandular setae about 150 on each side, arranged in 5 staggered rows, glandular setae one-fourth as long as sensory setae, sensory setae unilaterally pinnate, one-half as long as stylus I, 18+19, with large sockets, separated by one-half the width of a setal socket, stylus with four secondary cones, a short, recessed, mesad seta and one pore, all other styli similar, sterna II–VIII, apotomes 3+3M, sternites 12+12M, male setose sac opening on sternite III, extending anteriorly to the posterior margin of sternite II, with a whorl of 22 radially pinnate setae internally near the opening, no other setae in the sac, and a row of 12 simple setae external and posterior to the opening, pleura III–VII prepleurite 1M pinnate and 1M simple, pleurite 2M pinnate and 4m, sternum VIII 6+6M and 10+10m, segment IX pleurae meeting in midline, with 3+3M and 2+2m, segment X between the ventral carinae 7+7M. Genital area: posterior to the genital orifice a close row of 18 stout setae, entire area ringed by 16 widely spaced setae.

Forceps.—Dorsal articulation rounded, both arms long, slender, margins entire, without crenulations, except for a few basal teeth, left arm 2/1, right arm 2 teeth uniseriate, seta A one-third as long as adjacent seta, basal buttress absent.

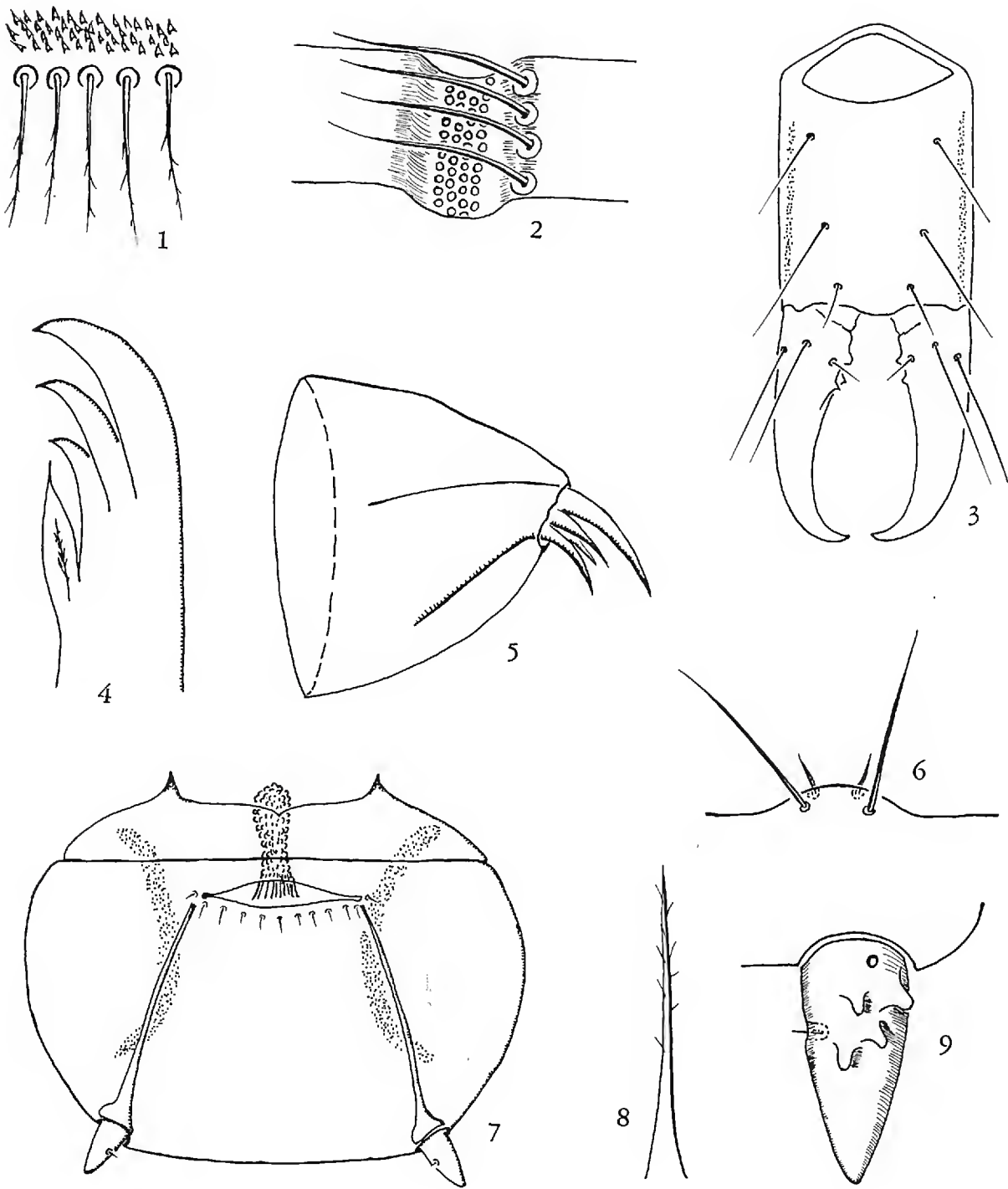
FEMALE unknown.

Length of body including forceps: ♂ 6.0 mm, third instar juvenile 3.0 mm. Since the third instar juvenile has 5+5 sensory setae in the lateral subcoxal organs, and the adult has 18+19 it is possible that it is a stage III male.

TYPE.—*Holotype male* in California Academy of Sciences; juvenile in University of California, Davis.

HABITAT.—*Holotype male* and one juvenile, 23 MILES SOUTH OF MATIAS ROMERO, OAXACA, MEXICO, elevation 500 feet, in leaf mold, 8 April 1962, collected by F. Parker and L. Stange.

The distance, airline, from the type locality of *C. boneti* Silvestri to the type locality of *C. parkeri* L. Smith is 1,200 miles. If this genus is found in the State of Jalisco, but not in Sonora or Sinaloa it will



EXPLANATION OF FIGURES

Figs. 1-9, Various structures of *Ctenjapyx parkeri* L. M. Smith. 1, Setae of the lateral subcoxal organ, short glandular setae and long, pinnate sensory setae. 2, a portion of the lateral groove of the head. 3, dorsal view of tergite X and forceps with distal setae omitted. 4, ventral view of left mandible showing prostheca. 5, tip of galea showing retractile thumb. 6, posterior view of labial palpus. 7, ventral view of sternite III showing setose male sac. 8, a single seta from the male setose sac. 9, dorsal view of stylus III.

support the idea that Baja California was at one time connected with Jalisco.

The two known species of *Ctenjapyx* may be separated as follows:

- Antenna with 26 segments, abdominal tergites with 7+7M, forceps left arm
2/1, right arm 2 uniseriate *C. parkeri* L. Smith
- Antenna with 25 segments, abdominal tergites with 5+5M, forceps left arm
with one large tooth, right arm with one small tooth *C. boneti* Silvestri

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- SILVESTRI, F. 1948. Specie di Japygidae (Insecta Diplura) finora raccolti nel Messico. Boll. Lab. Entomol. Agr. Portici, 8: 312.

ZOOLOGICAL NOMENCLATURE: Notice of proposed use of plenary powers in certain cases (A. [n.s.] 60).

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full details of which will be found in *Bulletin of Zoological Nomenclature*, Vol. 20, Part 5, published on 21 October 1963.

- (1) Validation of, and designation of a type-species for, *Diplectrona* Westwood, 1839 (Insecta, Trichoptera). Z.N.(S.) 1580;
- (2) Validation of *Ortholitha* Hubner (1825) (Insecta, Lepidoptera). Z.N.(S) 1585;
- (3) Validation of *Tinodes pusillus* McLachlan, 1862 (Insecta, Trichoptera). Z.N. (S.) 1592.

Any zoologist who wishes to comment on any of the above cases should do so in writing, and in duplicate, as soon as possible, and in any case before 21 April 1964. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 21 April 1964, be brought to the attention of the Commission at the time of commencement of voting.

All communications on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S. W. 7, England.—W. E. CHINA, *Acting Secretary to the International Commission on Zoological Nomenclature*.

Japygidae of North America 11: The Genus *Hecajapyx* (Diplura)

LESLIE M. SMITH
University of California, Davis

The genus *Hecajapyx* was described by Smith (1959) for the single species *H. vulgaris*. To the present time, this genus has remained monotypic. Additional collections of *H. vulgaris* have shown that this species is distributed throughout the Coast Range Mountains, from Marin County, California, northward into Klamath and Douglas Counties, Oregon. From the collector, Dr. J. G. Edwards, I received a series of eleven specimens from Fresno County, California which represent a new species of *Hecajapyx*. From a study of this new species and additional collections of *H. vulgaris*, it is now possible to define the genus *Hecajapyx* as follows:

HECAJAPYX, L. M. Smith

Antenna with 24 segments, terminal segment hemispherical with 8 placoid sensillae, trichobothria shorter than longest setae on same antennal segment, no ventral proliferation of setae on mid-segments of antenna, longest setae on segment 4 shorter than those on segments 3 or 5, distal lamina of lacinia falciform, external edge of galea with two short setae, thumb of galea not tapered but broadly rounded at tip, thoracic tergites 5, 6, 6, abdominal tergite I 2+2M or 3+3M, tergite II 4+4M, tergites III-VII 6+6M, tergite X 2+1+2M, and dorsal and ventral carinae distinct, posterolateral angles of tergite VII projected to the rear, of tergite VI rounded, lateral subcoxal organs occupying seven-eighths of the distance between the styli, composed of one row of glandular setae and one row of shorter sensory setae, sockets of sensory setae contiguous or separated by width of one setal socket, median subcoxal area blank and not protruding, pleurae IX meet with a wide sinus, styli with secondary cone not distinct and one external seta and one basal pore, empodium subequal to pretarsus. Forceps: seta A minute, dorsal articulation elongate, left arm with one pointed premedian and a larger rounded, postmedian tooth, interdental margin arcuate and biserially dentate with tubercles of the lower row more numerous than the upper row, right arm with one pointed premedian tooth and one larger, rounded postmedian tooth, interdental margin with 3 uniseriate tubercles, no setae in rectum, basal buttress present on both arms. Male with genital papillae nearly three times as long as wide, no setose sacs in sternites III or IV.

Hecajapyx bucketti L. M. Smith, new species

FEMALE.—Dorsum of head with about 12+12M each four times as long as stylus I, lacinia with a tooth, galea with two external setae (in all stages), thumb of galea slightly sclerotized with about 10 sensory cones of various lengths, terminal segment of maxillary palpus with about 20 setae three of which longer than that segment, antenna with 24 segments, segment III with 15 setae in distal whorl, of

which 6 large, and 9 setae in basal whorl, of which 3 large, labial palpus somewhat tapered and with two minute spines at the apex.

Thorax.—Setae typical with longest setae 3.5 times as long as stylus I, mesonotum prescutum with well developed cross and longitudinal apodemes, prescutum 1+1M and scutum 5+5M, metanotum prescutum 1+1M and scutum with 5+5M, coxae with 3 setae, protibia with one long ventral seta subequal to the tarsus, calcar setae elongate, meso- and meta-tibiae without the long ventral seta, calcar setae shorter, robust, tarsi with 4 or 5 stout setae per ventral row, dorsal apex of pro- and meso-femora with a close row of 5 setae, of metafemur with 6 setae.

Abdomen.—Tergite I prescutum 1+1M, scutum 1+1M and a few scattered microsetae, tergite II with anteromedian pair of setae very large and 3+3M (anterolateral setae absent), tergite III same but anteromedian pair smaller and one anterolateral seta at each side, tergites IV–VII with 3 anterolateral setae at each side (M_2 and M_3 of Pagés plus one more), tergite VII with anteromedian pair very small, tergite VIII 2+2M, tergite IX no setae, tergite X 2+1+2M between the carinae, pleuron IV prepleurite one long, one short, and two microsetae, pleurite one long, one short, and 6 microsetae. Sternum I apotome 4+4M alternating with m, sternite 12+12M and scattered microsetae, lateral subcoxal organ glandular setae three-fourths as long as stylus I, sensory setae three-fourths as long as glandular setae and about 10 per cent more numerous, no typical antecedent setae, sternites II–VII with 16+16M and numerous scattered m, sternite VIII with 7+7M, spermatophore burster long, tubular, enlarged anteriorly, pleurae IX, each with 2M, fused internally but leaving an external sinus equal to the length of stylus VII.

MALE similar to female, genital papilla two and one-half times as long as wide at the base, or 1.4 times as long as stylus VII.

Average body size and average number of glandular setae on one side of the lateral subcoxal organs for the several stages as follows:

	Glandular setae	Body length, mm
Third instar	16	6.0
Stage I ♂	24	9.0
Stage II ♂	34	11.5
Stage III ♂	41	13.0
Stage IV ♂	46	15.0
Stage I ♀	32	11.0
Stage II ♀	41	13.0

HABITAT.—*Holotype female*, paratype female, one juvenile, and 8 paratype males, MCKINLEY GROVE, NEAR DINKEY CREEK, FRESNO COUNTY, CALIFORNIA, under redwood duff, 29 April 1961, collected by J. G. Edwards.

I take pleasure in naming this species after Mr. J. S. Buckett who collected the series of *H. vulgaris* which is summarized below.

TYPE.—*Holotype female* and paratype male in California Academy of Sciences, paratypes in U.S.N.M. and University of California, Davis.

HECAJAPYX VULGARIS L. M. Smith

Additional information regarding this species is derived from a series of 130 specimens, collected 6 miles east of Petaluma, Sonoma County, California, 29 December 1961 by Mr. J. S. Buckett. The placoid sensillae on the terminal segment of the antenna are 8 (not 2 as reported by Smith, 1959), two setae on outer edge of galea in all stages. Average body size and average number of glandular setae on one side of the lateral subcoxal organs for the several stages are as follows:

	Glandular setae	Body length, mm
Third instar	13	5.0
Stage I ♂	22	7.5
Stage II ♂	33	9.0
Stage III ♂	40	10.5
Stage I ♀	26	8.0
Stage II ♀	35	10.0
Stage III ♀	49	11.5

The two species of the genus *Hecajapyx* may be distinguished as follows:

Abdominal tergite I scutum 1+1M, setae at apex of femur 5 or 6, setae on dorsum of head 4.0 times as long as stylus I, body length stage III ♂ 13 mm	<i>H. bucketti</i> , new species
Abdominal tergite I scutum 2+2M, setae at apex of femur 4, setae on dorsum of head 2.8 times as long as stylus I, body length stage III ♂ 10.5 mm	<i>H. vulgaris</i> L. Smith

LITERATURE CITED

- SMITH, L. M. 1959. The Japygidae (Diplura) of North America, 3. Am. Entomol. Soc. Amer., 52: 363-368.

BOOK REVIEW

INTRODUCTION TO HIGH ALTITUDE ENTOMOLOGY. (INSECT LIFE ABOVE THE TIMBER-LINE IN THE NORTH-WEST HIMALAYA). By M. S. Mani. Methuen & Co., Ltd., 36 Essex St., London, 302 pp., 80 figs. 1962. Price 42 Shillings.

This is the first general, comprehensive book dealing with animal ecology above timberline. Although numerous details of the Himalayan insect fauna are included,

most of the book will be as interesting and useful to botanists and to other zoologists as it is to entomologists. How do plants and animals survive in areas where the summer temperature may be 95° F in the sunny afternoon but below freezing a few hours after sunset? What do they do in environments where sunny surfaces may exceed 90° F while it is only 35° F in the nearby shade? Dr. Mani points out that high altitude *per se* does not have much direct effect on invertebrates, but that it does cause drastic environmental alterations with which all life must cope, or perish. These important environmental factors include aridity, temperature, wind, insolation, heat radiation, available water, and snow cover. In a series of ingenious diagrams, he indicates interrelationships between environmental, ecological, and biological factors at high altitudes. Tables are also included to compare temperature and humidity at different elevations, in different mountain ranges, during different seasons, and in different microhabitats. Dr. Mani discusses the life zones referred to by previous authors (alpine, arctic, montane, etc.), but for the North-West Himalaya he prefers to consider the *entire* biotic province, from timberline to the highest rocks, as the "nival zone."

The predominant emphasis throughout the book is ecological, with interesting sections on melanism, hygrophily, terricolity, cold stenothermy, flightlessness, crowding, dispersal, and niche preferences. In addition, there are excellent discussions of zoogeography, vertical distribution, life cycles, food chains, and general ecological interrelationships of the nival plants and animals. One chapter deals with the taxonomy of high-altitude insects, but there are no keys or descriptions of species included (the bibliography cites numerous taxonomic references, including several by Mani and his associates). The relative abundance of nival representatives of the various orders, families, and genera are compared, and the behavior, preferred habitats, and ecological niches of many of these insects are discussed. Fourteen orders of insects are known to be represented by permanent colonies above timberline in the Himalaya, of which the Coleoptera, Lepidoptera, Diptera, Collembola, and Plecoptera are the most abundant. Only about 400 species are actually *permanent* inhabitants above 5,800 feet in the North-West Himalaya, although 2,500 species have been collected there. The predominant order is Coleoptera, of which 45% of the species are Carabidae and 16% are Staphylinidae, while Tenebrionidae and Curculionidae each comprise more than 8% of the total. Similar analyses of the abundance of nival insect species of other orders are presented, as well as analyses of classes and orders of other Arthropoda.

Throughout the book there are excellent sketches and photographs to illustrate the habitats in which the author and his colleagues made their collections and observations, and each of the ten chapters includes a very complete list of selected references. The final chapter deals with the presumed origins of the nival insect fauna and with evolutionary factors and major evolutionary changes accompanying high-altitude adaptability.

This remarkable publication provides highly interesting, valuable, and practical information for *all* biologists, regardless of their individual fields of specialization. Undoubtedly there will be hundreds of subsequent publications on the subject as more extensive nival investigations are pursued, but regardless of future modifications and refinements Dr. Mani's book will surely continue to occupy a prominent niche on every biological bookshelf.—J. GORDON EDWARDS, *San Jose State College, San Jose, California.*

Biology of the Gall Wasp, *Eurytoma tumoris*, on Scots Pine¹ (Hymenoptera : Eurytomidae)

R. W. STARK AND C. S. KOEHLER²

University of California, Berkeley

The feeding habits of members of the genus *Eurytoma* Illiger are extremely diverse, including both parasitic and phytophagous species (Bugbee, 1951). Plant hosts include various weeds, wheat, and willow. The first published record of a eurytomid infesting a conifer (*Pinus banksiana* Lamb.) was by Thomas and Herdy in 1961.

In 1960, badly galled specimens of Scots pine, *Pinus sylvestris* L., were received by C. S. Davis, Extension Entomologist, University of California, from a Christmas tree farm in Santa Cruz County. Specimens of wasps reared from this material were described as a new species, *Eurytoma tumoris* by Bugbee (1962). Field studies were conducted from 1961 to 1963 to determine the biology of this insect.

DESCRIPTION OF STAGES

Egg.—The egg is pearly white, ovoid, with a short curved process at one end and a flagellate process, as long as the egg, at the other. Measurements of the lengths of eight eggs ranged from 0.51 to 0.58 mm (average 0.55 mm), exclusive of terminal processes. Width ranged from 0.17 to 0.22 mm (average = 0.19 mm). The eggs are deposited through the thin bark of one-year-old terminal and lateral growth and are found in the phloem-cambial layer with their long axis parallel to the grain of the wood. The oviposition site can be determined by the presence of a droplet of pitch on the bark which is exuded through the oviposition puncture.

Larva.—The larvae of *E. tumoris* do not differ morphologically from those of *E. calycis* (Thomas and Herdy, 1961) except for some variation in the setal pattern of mature larvae (Fig. 1, Table 1).

The number of larval instars was determined by measuring the distance between the mandible tip and the apex of the mandibular tooth. This procedure was adapted from that used by Strong (1962). Measurements of 77 individuals collected at irregular intervals during the larval period indicated that there are probably four instars (Fig. 2).³ About two months after eclosion presence of the larva is evidenced by a slight

¹ Studies supported in part by the T. B. Walker Foundation and various forest industries.

² Associate Professor and Assistant Entomologist respectively, Department of Entomology and Parasitology, University of California, Berkeley.

³ The authors are grateful to Mr. Maurice Tauber for his assistance in making these measurements.

Table 1.—Differences in setal pattern of mature larvae of *E. tumoris* Bugbee and *E. calycis* Bugbee.

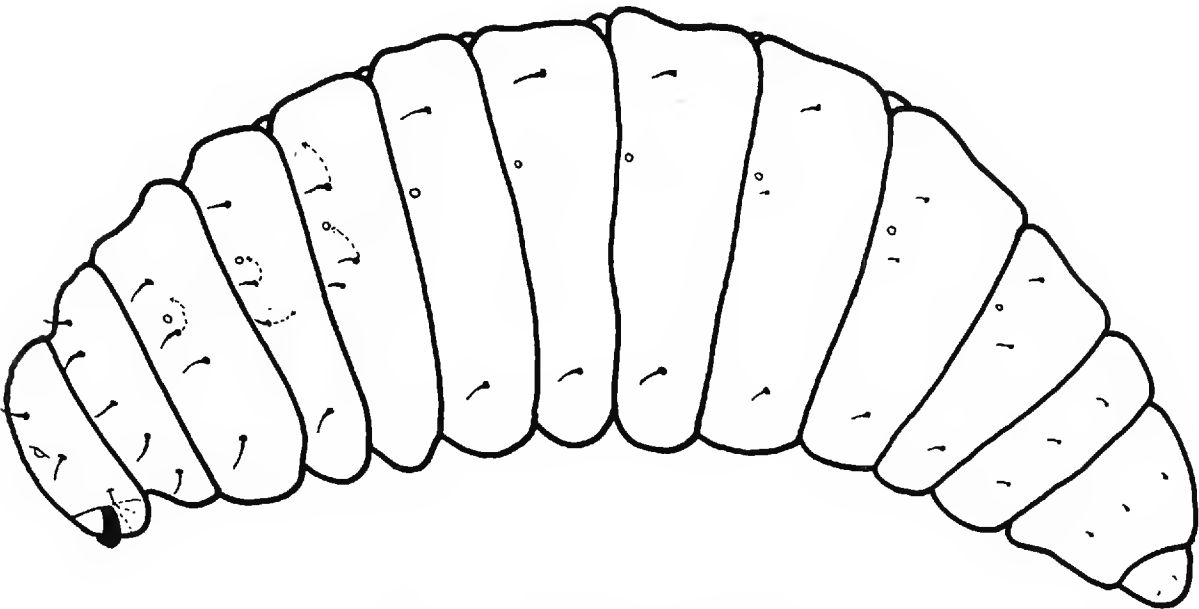
Segment	<i>E. tumoris</i>	<i>E. calycis</i> (from Thomas and Herdy, 1961)
Second thoracic	4 setae; 3 below spiracle and one above or two above and one below	5 setae; 3 below spiracle, 2 above
Third thoracic	4 setae; middle two variable in position	4 setae; apparently fixed
Abd. 2-4	2 setae per segment	3 setae per segment

swelling on the shoot or branch which becomes more pronounced as the larva develops.

Pupa and adult.—The exarate pupa has no distinctive characteristics. The adult is a small, 2.1–3.7 mm, black wasp with flecks of yellow at the base of the antennae and on the legs (Bugbee, 1962).

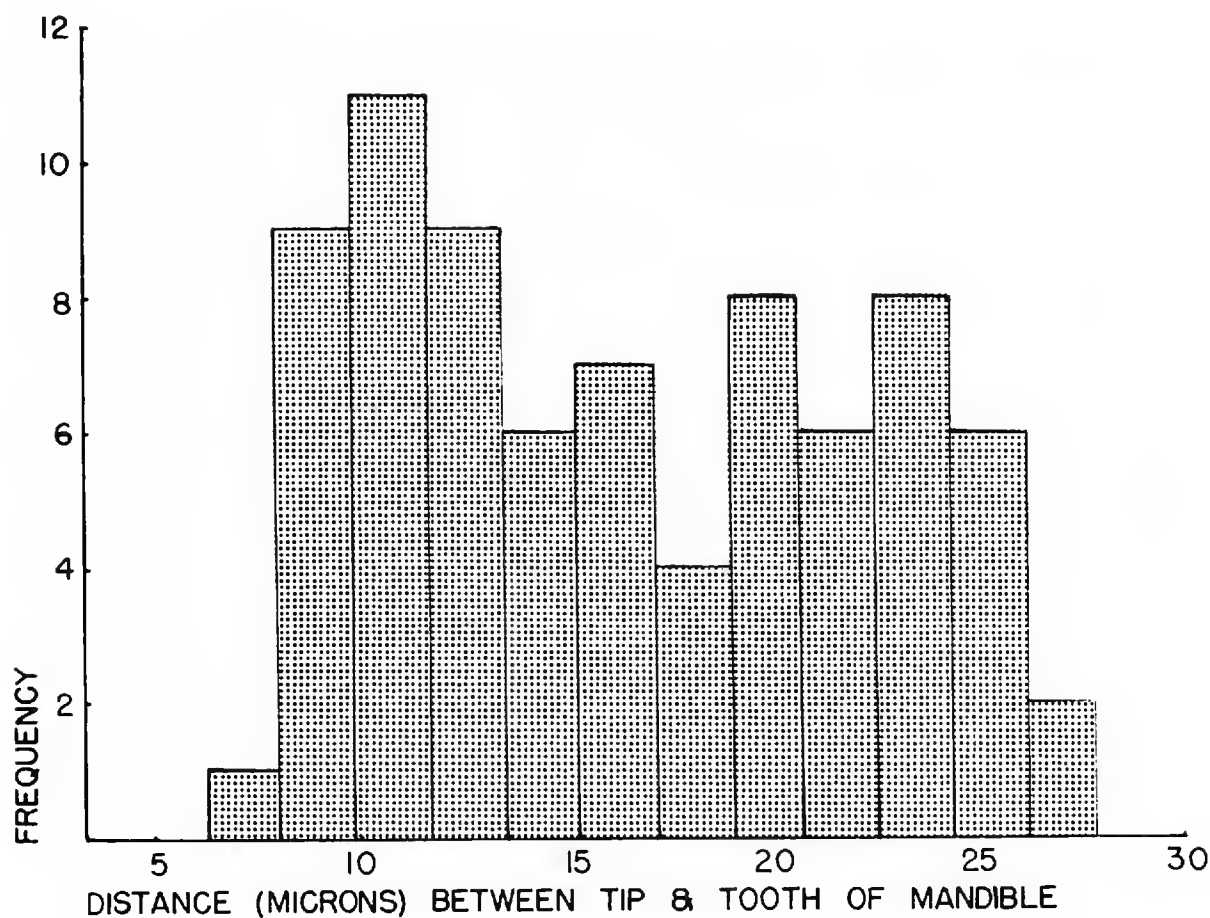
SEASONAL DEVELOPMENT AND DAMAGE

Emergence of adults begins in early April, reaches a peak in late April or early May, and continues until late in May. Eggs were found on 20 April through 22 May 1962 and it is assumed that oviposition closely follows emergence. Newly hatched larvae were also present on 20 April 1962, indicating that egg deposition and hatching commence in early or mid April. The larval stage persists until March or some-



EXPLANATION OF FIGURE

Fig. 1. Setal map of mature larva of *Eurytoma tumoris* Bugbee.



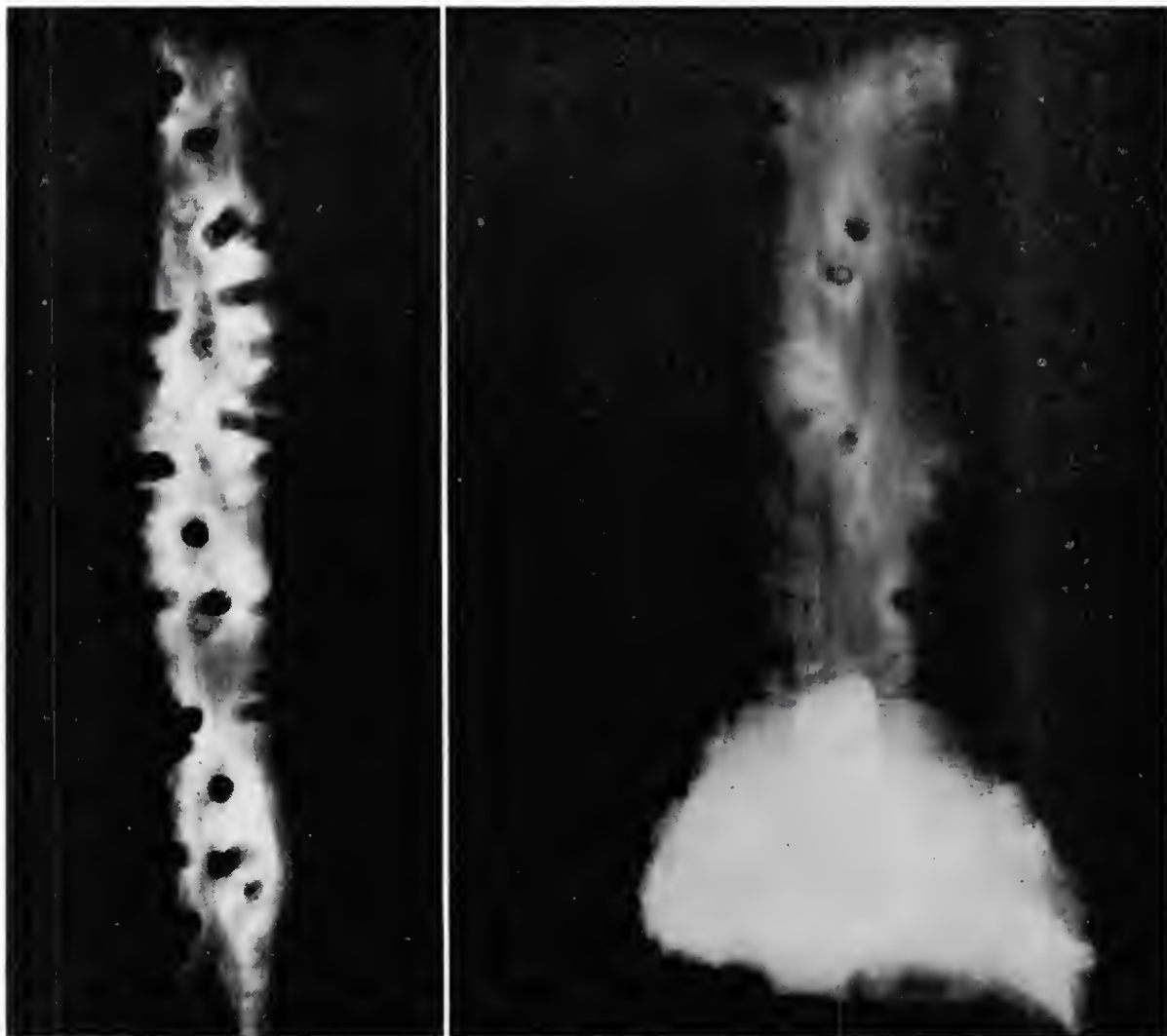
EXPLANATION OF FIGURE

Fig. 2. Histogram of measurements on mandibles of *Eurytoma tumoris*.

times April of the following year. The duration of the pupal period is unknown but is apparently brief.

On hatching, the young larvae feed in the phloem-cambial region. Gradual invasion of the wood occurs and new galls are evident by mid June. By late summer a deep cylindrical pit is made in which the larva apparently feeds and later overwinters (Figs. 3 and 4, C). The structural damage to the tree is slight. Growth in height is apparently unaffected and the interruption of diameter growth is restricted to the period when the wood is one year old (Fig. 4B). This aberration of growth rings is soon grown over (Fig. 4A) and as it occurs close to the pith, would not affect the lumber or pulp value of the mature tree. However, damage to Christmas tree stock is great. The permanent lumpy galls produced in large numbers on the terminal and lateral growths, exit holes of adults, and cracking of the bark on heavily galled trees seriously detract from its value. Indeed, such trees are virtually unsalable (Figs. 5A, B).

At the present time the insect is not abundant. Less than 10 per cent of the Christmas trees in a large planting were infested. Furthermore, infestation by *E. tumoris* shows little tendency toward rapid spread



EXPLANATION OF FIGURE

Fig. 3. X-ray of infested tips showing larval pits.

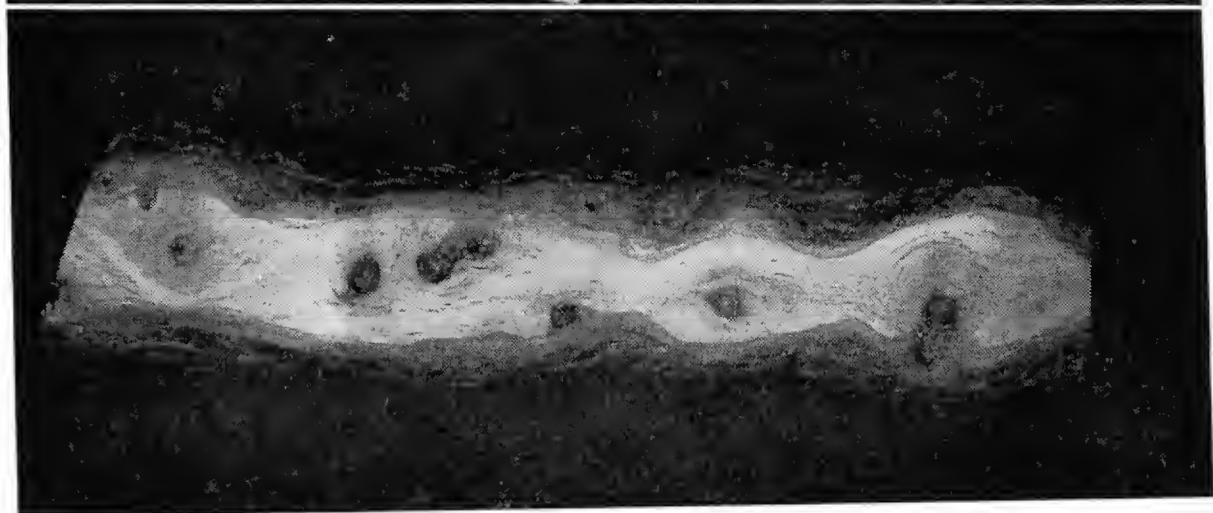
within a plantation. Many infested trees showed evidence of repeated attack since 1957. Adjacent trees in many instances were found totally free from infestation. Adults are sluggish, flying only when violently disturbed. This, coupled with the pattern of infestation, suggests that the females oviposit commonly in the same tree from which they emerged.

The notes on biology given above pertain only to *Eurytoma tumoris* Bugbee reared from, and observed attacking, Scots pine. However, galled Monterey pine, *Pinus radiata*, were found in the same plantation but no insects emerged from these. Gall-forming *Eurytoma* have been collected from lodgepole pine, ponderosa pine, and Jeffrey pine in

EXPLANATION OF FIGURES

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Fig. 4. (A, B, upper photographs) Cross-sections of infested stems showing current larval pit and emergence hole (B), and the growth of the tree over the holes in subsequent years (A). (C, lower photograph) Longitudinal section of infested tip showing larval pits and growth deformation.





EXPLANATION OF FIGURES

Fig. 5. (A, left photograph) Stem of a Scots pine Christmas tree which has been repeatedly infested. (B, right photograph) "Gouting" of branches caused by *Eurytoma tumoris* attack.

California,⁴ but it is not known as yet whether these are the same species as that attacking Scots pine.

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⁴ Personal communication. C. B. Eaton, Pacific Southwest Forest and Range Experiment Station, U. S. Forest Service, Berkeley.

Experiments on Reproductive Isolation in *Cimex lectularius* and *Cimex columbarius*¹

(Hemiptera : Cimicidae)

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The pigeon bug, *Cimex columbarius*, was described by Jenyns (1839) as a distinct species differing from the human bedbug, *Cimex lectularius* Linnaeus, in the length of the third and fourth antennal segments. Because they are so closely related morphologically, many arguments were later published on the taxonomic status of *C. columbarius*, whether it is a valid species, a synonym, or a subspecies of *C. lectularius*. Johnson (1939) studied *C. lectularius* and *C. columbarius* intensively, making measurements of external characters and crossing experiments although no details of the fertility of crosses were presented, and concluded that *C. columbarius* is a subspecies of *C. lectularius*. Since then Johnson's view has been generally accepted. Darlington (1939) studied both species and their hybrids cytologically. In *C. lectularius* he found supernumerary X chromosomes which varied in number from two to fifteen in the males, not only in different individuals, but within individuals. *C. columbarius* was very stable in its number of chromosomes and no supernumerary X chromosomes were found. Also he reported the following in the hybrids: the males produced by *columbarius* ($\varnothing \varnothing$) $\times$ *lectularius* ($\delta \delta$) had $26A + X_1X_2Y$, while the males produced by *lectularius* ($\varnothing \varnothing$) $\times$ *columbarius* ($\delta \delta$) had 26 autosomes, a single Y, and three to seven X chromosomes. This suggests that transmission of supernumerary X chromosomes is due to the females of *C. lectularius*.

During the course of experimental hybridizations in the genus *Cimex*, at the University of California, interesting results were obtained which clarify the taxonomic status of *C. lectularius* and *C. columbarius*.

The author wishes to express his grateful thanks to Dr. R. L. Usinger, Department of Entomology, University of California, for his help and criticism during the course of the study. Also the author would like to express his thanks to Mr. P. D. Ashlock of the same department, for reading through the manuscript.

EXPERIMENTS AND RESULTS

For the experiments, *Cimex lectularius* from Cairo, Egypt and from Berkeley, California (collected in human dwellings) and *Cimex colum-*

¹ This study was supported by a grant (AI-01496-07) from the National Institutes of Health.

barius from South Finland (collected in nests of the flycatcher, *Muscicapa atricapilla*) were used. These colonies were reared for several years on a chicken. Fifth instar nymphs of these colonies were isolated individually in small vials, and then virgin female adults were obtained. Ten females of each of two species or strains (20 females in total) were placed in a vial with ten males of one of these species or strains in the six possible combinations (Tables 1 and 2). The two species, *C. lectularius* and *C. columbarius*, are almost indistinguishable morphologically, so the bristles on the right wing pad were removed in females of one species to make sure that the two species could be recognized. The same method was applied to the two strains of *C. lectularius*. To see whether the artificial marks were recognized by the bugs, reference may be made to the following two experiments. In the first, the bristles of homogametic females (that is, females and males of the same species or strains) were removed but bristles were not removed from heterogametic females (that is, females and males of different species or strains) and from the males. In the second experiments, the bristles of the heterogametic females were removed but not those of the homogametic females and the males. For example, in the cross comprising females of *columbarius* and *lectularius* and males of *columbarius*, the bristles of *columbarius* (homogametic) females were removed (cited as Ex. 1 in the tables) and in the cross comprising females of *columbarius* and *lectularius* and males of *columbarius*, the bristles of *lectularius* (heterogametic) females were removed (cited as Ex. 2 in the tables). One and two days later, the females were dissected and examined for sperm. Sperm were easily located near the cavity of spermatheca because of the unique method of hemocoelic fertilization. When sperm were present in a female, the bug was recorded as inseminated, although the amount of sperm in an inseminated female varies greatly. Statistically no significant difference was obtained between the first and second experiments (see Tables 1 and 2).

The results of the experiments are given in Tables 1 and 2. Also χ^2 and the isolation index (Stalker, 1942) are calculated. It is evident at a glance that the χ^2 values are always higher than 6.6 (corresponding to the 0.01 probability level) in the crosses between *C. lectularius* and *C. columbarius* and there are significant deviations from random mating between the two species. In the conspecific crosses (between two strains of *C. lectularius*) the χ^2 values are always lower than 1.07 (corresponding to the 0.30 probability level) and there are no significant deviations from random mating between two strains of *C. lectularius*. The isolation index indicates the degree of isolation between species or strains of

Table 1. Number of females examined (*n*) and per cent inseminated females (%) in crosses (24 hr).

Females	Males	Ex.*	Homogametic		Heterogametic		χ^2	Isolation index
			<i>n</i>	%	<i>n</i>	%		
<i>columbarius</i> , <i>lectularius</i> (from Cairo)	<i>columbarius</i>	1	10	90	10	20	9.86	0.64
		2	10	80	10	20	7.20	0.60
		T	20	85	20	20	16.94	0.62
<i>columbarius</i> , <i>lectularius</i> (from Cairo)	<i>lectularius</i> (from Cairo)	1	10	100	10	0	20.00	1.00
		2	10	80	10	10	9.89	0.78
		T	20	90	20	5	28.97	0.89
<i>columbarius</i> , <i>lectularius</i> (from Berkeley)	<i>columbarius</i>	1	10	90	10	20	9.86	0.64
		2	10	100	10	30	10.77	0.54
		T	20	95	20	25	20.42	0.58
<i>columbarius</i> , <i>lectularius</i> (from Berkeley)	<i>lectularius</i> (from Berkeley)	1	10	90	10	10	12.80	0.80
		2	10	80	10	10	9.89	0.78
		T	20	85	20	10	22.56	0.79
<i>lectularius</i> , <i>lectularius</i> (from Cairo)	<i>lectularius</i> (from Cairo)	1	10	90	10	90	0	0
		2	10	90	10	80	0.39	0.06
		T	20	90	20	85	0.23	0.03
<i>lectularius</i> , <i>lectularius</i> (from Cairo)	<i>lectularius</i> (from Berkeley)	1	10	80	10	90	0.39	-0.06
		2	10	100	10	90	1.05	0.05
		T	20	90	20	90	0	0

* 1: first experimental set with the bristles on the right wing pad of homogametic females removed.
2: second experimental set with the bristles on the right wing pad of heterogametic females removed.
T: total of the first and second experiments.

a species. If the isolation between the species or strains tested is complete the index is 1.0; if the mating takes place at random the index is zero. In all interspecific crosses a positive isolation index is obtained, which means that males of both species inseminate more of their own females than of those of the other species. Also, the isolation index is usually higher than 0.50 and is higher when *lectularius* males are inseminating than when *columbarius* males are inseminating. In all intraspecific crosses the isolation index is nearly zero, which indicates that no significant isolation takes place between the two strains of *C. lectularius*.

Table 3 shows the fertility of inter- and intraspecific crosses in the *Cimex lectularius* complex. Virgin females of each were obtained in the same manner as in the previous experiments. Single mating pairs, replicated ten times for each of the six possible combinations were used for this experiment. Mean and standard error of the mean of the number of eggs laid were obtained from the ten sets of single pair matings in each of the crosses. As has been described by several authors, the Cimicidae have a peculiar behavior in laying eggs. In most insects, the female is able to lay eggs without mating, although such eggs are infertile. But in the Cimicidae, no eggs can be laid without insemination having taken place. In Table 3, the number of eggs laid by *C. columbarius* females in the crosses is distinctly lower than the other crosses. When a comparison between Table 3 and Table 1 or 2 is made, the relative percentage of *columbarius* females inseminated by *lectularius* males (either of the Cairo or Berkeley strains) is higher than the percentage of eggs laid in the same crosses. This may indicate that *lectularius* sperm are killed by an antiserum reaction in *columbarius* females which is common in interspecific crosses.

DISCUSSION

Although *Cimex columbarius* Jenyns (1839) differs from *Cimex lectularius* Linnaeus (1758) in hosts and in the ratio of head width and length of third antennal segment, the two forms are very closely related morphologically and are very difficult to distinguish. Therefore, the taxonomic status of these two species has been confused for a long time. Johnson (1939) suggested that *C. columbarius* was a subspecies of *C. lectularius* rather than a distinct species, and based his conclusion on his analysis of morphological characters and crossing experiments. His conclusion seemed to gain general acceptance, but the problem of taxonomic status still existed, depending on whether the two forms are considered to be sympatric or allopatric. If they are

Table 2. Number of females examined (*n*) and per cent inseminated females (%) in crosses (48 hr).

Females	Males	Ex.	Homogametic		Heterogametic		χ^2	Isolation index
			<i>n</i>	%	<i>n</i>	%		
<i>columbarius</i> , <i>lectularius</i> (from Cairo)	<i>columbarius</i>	1	10	100	10	50	6.66	0.33
		2	10	100	10	30	10.77	0.54
		T	20	100	20	40	17.14	0.43
<i>columbarius</i> , <i>lectularius</i> (from Cairo)	<i>lectularius</i> (from Cairo)	1	10	100	10	10	16.36	0.82
		2	10	100	10	30	10.77	0.54
		T	20	100	20	20	26.66	0.66
<i>columbarius</i> , <i>lectularius</i> (from Berkeley)	<i>columbarius</i>	1	10	90	10	30	7.50	0.50
		2	10	90	10	10	12.80	0.80
		T	20	90	20	20	28.97	0.64
<i>columbarius</i> , <i>lectularius</i> (from Berkeley)	<i>lectularius</i> (from Berkeley)	1	10	80	10	20	7.20	0.60
		2	10	90	10	10	12.80	0.80
		T	20	85	20	15	26.35	0.73
<i>lectularius</i> , <i>lectularius</i> (from Cairo) (from Berkeley)	<i>lectularius</i> (from Cairo)	1	10	100	10	90	1.05	0.05
		2	10	90	10	90	0	0
		T	20	95	20	90	0.36	0.03
<i>lectularius</i> , <i>lectularius</i> (from Cairo) (from Berkeley)	<i>lectularius</i> (from Berkeley)	1	10	100	10	100	0	0
		2	10	90	10	100	1.05	-0.05
		T	20	95	20	100	1.03	-0.03

allopatric, Johnson’s concept may be correct. But it is difficult to assume that these bugs are allopatric. Clay (1949) believes that parasites which are host specific may be allopatric, even though their hosts may be sympatric. For example, the Mallophaga can be allopatric, even though their hosts are sympatric, because they spend their entire lives and breed on their hosts (Mayr, 1963). *C. lectularius* and *C. columbarius* may be sympatric, even though they are host specific. They remain on their hosts only when they are feeding, and spend the rest of their time in cracks and crevices. Therefore, the possible coexistence of both species is easily assumed in a same habitat. For example, in a building, *C.*

Table 3. Mean and its standard error of number of eggs laid (ten females and ten males of single pair mating) in the interspecific and intraspecific crosses in the *Cimex lectularius* complex.

Female	Male		
	<i>C. columbarius</i>	<i>C. lectularius</i> (from Cairo)	<i>C. lectularius</i> (from Berkeley)
<i>C. columbarius</i>	—	1.9 ± 1.32	0.4 ± 0.40
<i>C. lectularius</i> (from Cairo)	24.3 ± 3.26	—	40.3 ± 2.74
<i>C. lectularius</i> (from Berkeley)	32.5 ± 4.98	36.2 ± 2.30	—

lectularius may live around humans and *C. columbarius* may live around the pigeons in a loft overhead. Then they have many opportunities to contact each other, and would be sympatric. In this situation, which actually exists in the Netherlands, there can be no possibility of a subspecific relationship, and the only possible question concerns specific distinctness. If they are the same species, they should not be reproductively isolated. The data of the experiments (Tables 1, 2, and 3) clearly indicate the existence of reproductive isolation between them. They are sympatric, host specific, and largely reproductively isolated, although they are morphologically exceedingly similar. This evidence indicates that the two forms are sibling species (Mayr, 1963).

Cytological study of these species and their hybrids has been done by Darlington (1939) and myself (unpublished). No essential differences of chromosome cytology were found between these two species, although *C. lectularius* commonly has supernumerary X chromosomes. The essential chromosome complement of both species is 26A + X₁X₂Y

in the males and $26A + X_1X_1X_2X_2$ in the females. The number of supernumerary X chromosomes in *C. lectularius* is quite variable among the populations or strains, while in *C. columbarius* no supernumerary X chromosomes have ever been observed and the chromosome complement is very consistent. In the hybrids between *C. lectularius* and *C. columbarius* and both reciprocals, only small abnormalities and irregularities in meiosis are observed. Therefore, there is no serious barrier to the production of successive generations (which are actually obtained in the laboratory), although their fertilities are lower than their parents. Also the transmission of supernumerary X chromosomes from *lectularius* to *columbarius* or from *lectularius* to *lectularius* between different populations or strains is quite complicated and will be discussed in a separate paper.

SUMMARY

The taxonomic status of the human bedbug, *Cimex lectularius*, and the pigeon bug, *Cimex columbarius*, has been confused for a long time because the two forms are very closely related morphologically and very difficult to distinguish. During the course of experimental hybridizations in the genus *Cimex*, the existence of reproductive isolation was found between two species (see Tables 1–3). This evidence indicates that these two forms are sibling species rather than subspecies.

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Description of the Male of *Xyelecia nearctica*, with Comments on the Genus

(Hymenoptera : Xyelidae)

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The genus *Xyelecia* was described by Ross in 1932 to contain *Xyelecia nearctica* Ross, which he described at the same time. No other species have been described to date. It is distinguished from other members of the family Xyelidae by its large size (6.0 to 9.5 mm), long antennal thread (Fig. 1), the short, broad sheath of the female (Fig. 2), and the wing venation. On the basis of its distinctiveness, Benson (1945) erected a new subfamily, Xyeleciinae, to contain this genus.

A collection of sawflies which was recently received from Mr. Joe Schuh of Klamath Falls, Oregon, included a good series of males and females of this species. This is the first time the males have been definitely associated with the females.

XYELECIA NEARCTICA ROSS

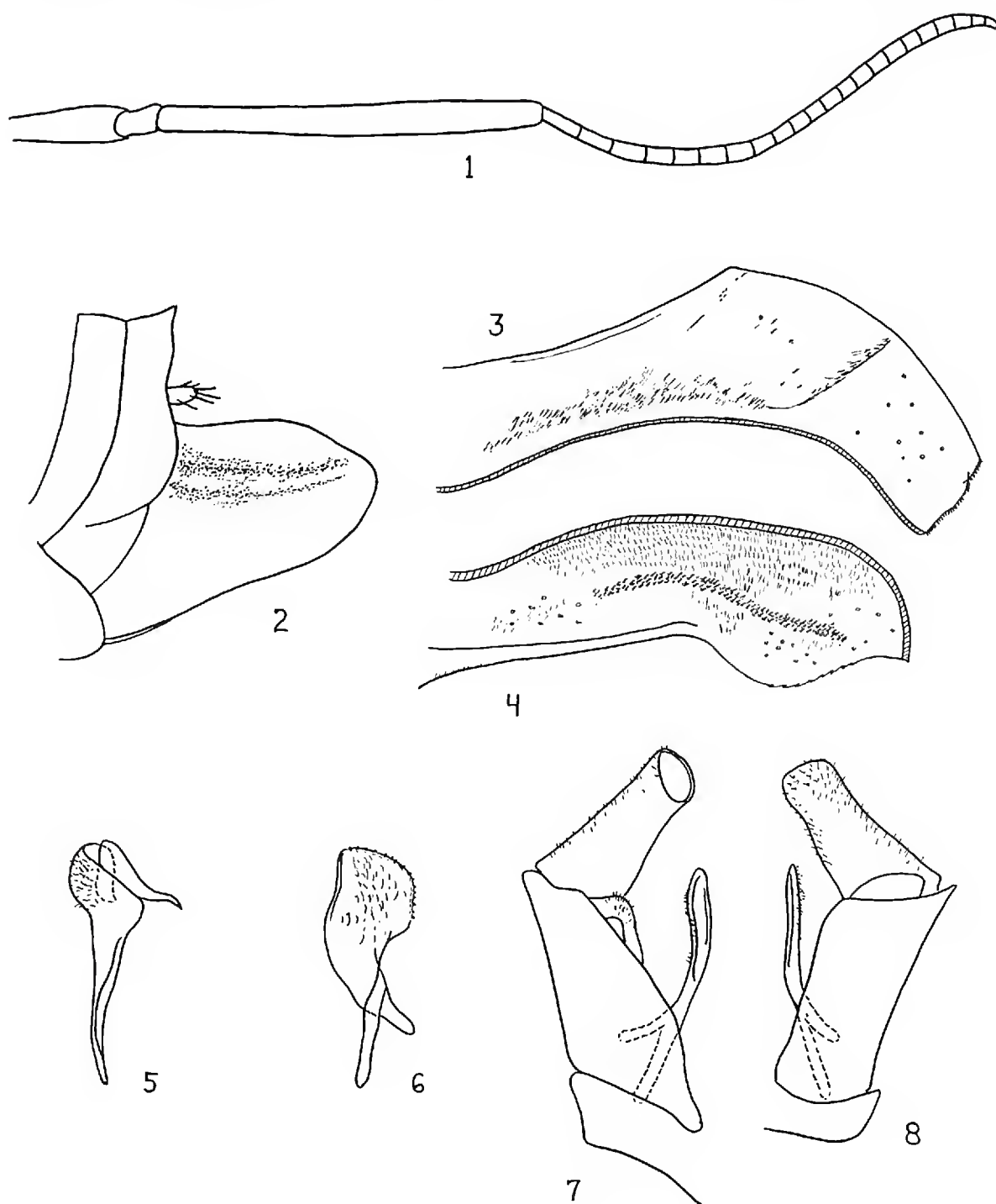
MALE.—Length 6.0 to 7.5 mm; length of forewing 7.1 to 9.0 mm. Similar to female in structure but differs slightly in color pattern. *Head* and antennae black except for the labrum, lower and lateral portions of the clypeus, a narrow band surrounding the eyes, and labium creamy white; tips of mandibles reddish. *Thorax* black except for area at base of wings, ventrolateral portion of pronotum, and spot near anterior margin of the mesepisternum whitish. Coxae black with white spot at apex; femur ferrugineous; tibiae and tarsi brown to black. *Wings* hyaline; stigma and veins brown. *Abdomen* black except for white bands on posterior portion of segments, more pronounced on sternites. Genitalia black.

Locality.—Mt. Pitt Trail, Klamath County, Oregon, 14 June 1959, *Abies concolor*, Joe Schuh, 14 males, 3 females.

The color shows little variation in the specimens available. The females are more brownish when compared with the predominately black males. The male genitalia (Figs. 7, 8) are orthandrous in position, resembling in this respect *Macroxyela* and *Megaxyela*. They are very similar in appearance to *Macroxyela ferruginea* (Say), (Snodgrass, 1941). The male genitalia of the other North American genera, *Xyela* and *Pleroneura*, are strophandrous.

Biology and host information are unknown except that it has been collected mainly by beating conifers. Available records show that this species occurs primarily in the Northwest; however, there is one questionable record from Montana and Colorado.

Records to date include the following: IDAHO: Moscow, J. M. Aldrich, 1 female (paratype, in the Canadian National Collection) (Ross, 1932). OREGON: White Branch Meadow, Three Sisters, Frog Camp, elevation approximately 5500 ft, 19 July 1927, H. A. Scullen, 1 female (*holotype*, in the Illinois Natural History Survey collection)



EXPLANATION OF FIGURES

Figs. 1-8, *Xyelecia nearctica*. 1, antenna (from Ross, 1932). 2, female sheath, lateral aspect (from Ross, 1932). 3, female lance, lateral aspect. 4, female lancet, lateral aspect. 5, volsella of male genital capsule, ventral aspect. 6, penis valve of male genital capsule, lateral aspect. 7, male genital capsule, ventral aspect. 8, male genital capsule, dorsal aspect.

(Ross, 1932); Corvallis, 20 April 1930, J. Wilcox, 1 female; 4 mi. S. 4-mile Lake, Klamath County, 4 June 1959, beating conifer, Joe Schuh, 4 females; Gearheart Mt., base, Klamath County, 7 June 1959, on *Pinus contorta*, Joe Schuh, 1 female; Spenser Creek, Klamath County, 1 July 1956, J. D. Vertrees, 3 females; Mt. Pitt Trail, Klamath County, 14 June 1959, *Abies concolor*, Joe Schuh, 14 males, 3 females. WASHINGTON: Paradise Valley, Rainier N. P., 16 July 1936, E. C. Van Dyke; Mt. Baker Lodge, 1 July 1936, E. C. Van Dyke.

This species has also been recorded from California (1 female) and “?Colorado and Montana, 1925, H. G. Dyar” (1 male), (*personal communication*, Dr. B. D. Burks, 1962).

The specimens from which the description was taken are in the Oregon State University insect collection. Representatives have been distributed to the following: Dr. H. H. Ross, Illinois Natural History Survey; Dr. W. W. Middlekauff, University of California; Mr. R. B. Benson, British Museum of Natural History; Dr. B. D. Burks, U. S. National Museum; and Dr. D. J. Burdick, Fresno State College.

ACKNOWLEDGMENTS

Thanks are due to Mr. R. B. Benson of the British Museum, Dr. B. D. Burks of the U. S. National Museum, and Mr. Joe Schuh of Klamath Falls, Oregon.

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A New Species of *Endeodes* from Sonora, Mexico

(Coleoptera : Melyridae)

IAN MOORE

San Diego Museum of Natural History

Although the marine invertebrate fauna of the Gulf of California largely belongs to the Panamic fauna, numerous elements in the northern half of the gulf show definite affiliations with the Californian fauna. Consequently, it is not a great surprise to find in the northern Gulf of California a species of marine insect belonging to a genus typical of the California coast.

The *Endeodes* described below is most closely related to *basalis* and *blaisdelli*, respectively from Southern California and the Pacific Coast of Lower California. Adults of these two species are found not uncommonly beneath dry seaweed on the berm of sandy beaches. Their larvae have never been found. The larvae of the present species, like that of the northern *collaris*, were found in cracks in the rocks of an exposed reef below daily high tide. The single adult was found running on the reef.

Endeodes sonorensis Moore, new species

Color.—Head and pronotum ferruginous with the eyes black; elytra deep black with a steel blue cast, the base and humeri narrowly orange; scutellum ferruginous; abdomen largely ferruginous, each segment with an indefinitely bounded round piceous central spot, the last segment almost entirely piceous; antennae with the first segment ferruginous, the remainder progressively darker, the apical segments piceous; legs ferruginous with the femora faintly infumate; beneath ferruginous except the metasternum which is piceous.

Head.—Oval, about as long as wide; finely, moderately punctured throughout; without ground sculpture; with short, fine, gray pubescence.

Pronotum.—A little wider than long, widest in apical fourth; apex rounded; sides rounded, not sinuate before hind angles; base straight, narrower than apex. Punctures as fine, but a little sparser, than on head. Without ground sculpture. Pubescence fine, short, black.

Elytra.—Each elytron about twice as long as wide; sides arcuate; base arcuate; punctures similar to those of elytra; ground sculpture a very fine microreticulation not visible except under high power.

Abdomen.—Wider than elytra. Sculpture as on elytra. Beneath much more sparsely punctured than above.

Holotype female.—PUNTA DE LOS CUERVOS, SAN CARLOS BAY, NEAR GUAYMAS, SONORA, MEXICO, 18 November 1962, Ian Moore, collector, specimen deposited in the California Academy of Sciences. Found running on the surface of the reef exposed during low tide. Two larvae were taken from cracks in the rocks at the same locality.

Notes.—This species resembles *terminalis*, *basalis*, and *blaisdelli* in its long elytra, but differs from the second two in the pronotum being a little wider than long with the sides evenly arcuate into the broadly rounded hind angles. In *basalis* and *blaisdelli* the pronotum is a little longer than wide, the sides are distinctly sinuate before the hind angles. *E. terminalis* has the elytral apices pale and the abdomen entirely black.

Larva.—Bright ferruginous except the head dark ferruginous, legs testaceous and the urogomphus piceous, with the apices paler. Very similar in structure to the other known larvae of the genus.

KEY TO THE SPECIES OF ENDEODES

- 1a. Each elytron at least twice as long as wide 2
- 2a. Sides of pronotum sinuate before hind angles 3
- 3a. Elytra concolorous, pale ferruginous *blaisdelli*
- 3b. Elytra bicolored, ferruginous basally, black apically *basalis*
- 2b. Sides of pronotum not sinuate before hind angles 4
- 4a. Elytra black with apices rufotestaceous *terminalis*
- 4b. Elytra black with base and humeri narrowly orange *sonorensis*
- 1b. Each elytron little longer than wide 5
- 5a. Legs, antennae, and mouthparts not darker than pronotum *insularis*
- 5b. Legs, antennae, and mouthparts darker than pronotum 6
- 6a. Head black *collaris*
- 6b. Head reddish *rugiceps*

KEY TO THE KNOWN LARVAE OF ENDEODES

- 1a. Body largely piceous 2
- 2a. Urogomphus black *collaris*
- 2b. Urogomphus black and ferruginous *rugiceps*
- 1b. Body largely bright ferruginous *sonorensis*

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Freshly Scorched Pines Attract Large Numbers of *Arhopalus asperatus* Adults

(Coleoptera : Cerambycidae)

BOYD E. WICKMAN

*Pacific Southwest Forest and Range Experiment Station
Forest Service, U. S. Department of Agriculture
Berkeley, California*

Heretofore unreported attack habits of adult *Arhopalus asperatus* (LeConte) were observed after lightning struck a pine stand 3 miles northeast of Hat Creek, Shasta County, California, on the evening of 24 July 1962. During the small forest fire that ensued, 15 mature pines (*Pinus ponderosa* Laws., *P. jeffreyi* Grev. & Balf., and *P. sabiniana* Dougl.) and 6 incense-cedars (*Libocedrus decurrens* Torr.) were badly scorched on one side of the bole to a height of 20 feet. The foliage of some of the trees also was severely scorched.

At 5 a.m. the next day, dozens of adult *Arhopalus asperatus* were found on the basal 3 feet of the most severely scorched ponderosa, Digger, and Jeffrey pines. No beetles were found on the incense-cedar. Several pairs were mating, and other adults appeared to be seeking oviposition sites. The fire at that time had been controlled, but was still producing some smoke. The basal portions of the attacked trees were still warm, but not smoking.

Adult activity and attraction to the scorched trees appeared to decrease as the day advanced, light intensity increased, and temperatures rose. The attractiveness of the trees also seemed to diminish with the passage of time; 2 days later, only four adults could be found resting on the stump of a felled, scorched Jeffrey pine.

This is the only reported instance of *Arhopalus asperatus* being attracted to burned timber, but a similar response has been reported among certain other insects, such as *Melanophila* beetles (Linsley, 1943) and smokeflies (Kessel, 1958, 1960). Gardiner (1957) successfully attracted cerambycids to smoke in experiments with a smoke generator. Furniss (1937) reported that adults of a closely related species, *A. productus* (LeConte), were attracted to burned trees.

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BOOK NOTICE

A REVIEW OF THE BIOLOGICAL CONTROL ATTEMPTS AGAINST INSECTS AND WEEDS IN CANADA. Commonwealth Agricultural Bureaux, Farnham Royal, Bucks, England. xii + 216 pp., incl. 17 maps. 1962. For sale by the Central Sales of the Bureaux, price 35 shillings.

After a foreword by F. J. Simmonds and a preface by R. Glen, the text is divided into three parts, of which only two receive title-page recognition. Part I—Biological control of pests of crops, fruit trees, ornamentals, and weeds in Canada up to 1959, by J. H. McLeod (pp. 1-34, including an index). Part II—Biological control of forest insects—1910-1958, by B. M. McGugan and H. C. Coppel (pp. 35-128, including maps and list of references). A third part, Appendix I and Appendix II, comprises the invaluable detailed listings of parasites and predators released against forest insects in Canada, 1910-1958, and Recoveries of parasites and predators employed in biological control projects against forest insects in Canada, 1910-1958 (pp. 129-176 and 177-210), both compiled by A. R. Graham and P. A. Jones.—HUGH B. LEECH, *California Academy of Sciences, San Francisco*.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

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PROCEEDINGS

TWO HUNDRED AND EIGHTY-FOURTH MEETING

The 284th meeting was held Friday, 15 February 1963, at 7:45 p.m., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (47): J. R. Anderson, F. L. Blanc, R. M. Bohart, W. M. Brooks, L. E. Caltagirone, D. Cavagnaro, M. M. Collins, H. V. Daly, R. L. Doutt, J. G. Edwards, W. E. Ferguson, K. E. Frick, R. H. Gonzalez, R. H. Goodwin, A. A. Grigarick, W. G. Iltis, M. Irwin, D. Jamieson, D. Janzen, D. H. Kistner, R. L. Langston, H. B. Leech, C. D. MacNeill, H. L. McKenzie, A. E. Michelbacher, W. D. Murray, Trudy V. Noller, J. A. Powell, F. C. Raney, E. S. Ross, Judy Ross, R. F. Schoeppner, T. Seeno, W. E. Simonds, F. E. Skinner, C. Slobodchikoff, J. Snell, G. I. Stage, L. A. Stange, H. E. Stark, W. A. Steffan, J. W. Tilden, Catherine Toschi, Nancy Twomey, R. L. Usinger, D. Viers, V. Whitehead.

Visitors present (21): Margaret Bohart, S. W. Broodryk, G. W. Byers, R. E. Eastwood, L. K. Etzel, R. E. Hall, R. B. Hawkes, Karen Janzen, E. Jessen, Mrs. D. H. Kistner, Mrs. R. L. Langston, Mrs. H. L. McKenzie, P. S. and Mrs. Messenger, Martha Michelbacher, Mrs. W. D. Murray, A. W. Pickett, Irene Pogojeff, H. E. Scholtz, A. Willink, Barbara A. Wilson.

The minutes of the meeting held 14 December 1962 were summarized.

Ten new members were elected: E. C. Carlson, D. Cavagnero, Trudy Noller, and F. C. Raney, Davis, California; J. R. Crosiar, Porterville, California; M. Collins and B. E. Wickman, Berkeley, California; Y. Hokama, Sacramento, California; M. M. J. Lavoipierre, San Francisco, California; C. M. Myers, Fresno, California. In addition, L. E. Caltagirone, Albany, California; Judy Ross, Berkeley, California; and R. B. Selander, Urbana, Illinois were reinstated to membership.

Stylopized wasp.—DR. J. W. TILDEN displayed a wasp, *Polistes annularis*, collected in Texas, with 13 stylops, *Xenos pallidus* Brues. This appears to be a record number of stylops for a single host.

Stylopized bees.—MR. M. E. IRWIN displayed a collection of *Dufourea trochantera* G. Bohart from the California Sierra which were stylopized by an undescribed species of Strepsiptera of the genus *Eurystylops*. Photographs of dissected gravid females and of a first instar larva were shown. No male *Eurystylops* have ever been found.

The principal speaker of the evening was MR. F. L. BLANC, Entomologist, California State Department of Agriculture, Sacramento. His illustrated lecture was on "Problems in identification of California fruitflies."

A coffee social in the entomology rooms followed the meeting.—HOWELL V. DALY, *Secretary*

TWO HUNDRED AND EIGHTY-FIFTH MEETING

The 285th meeting was held Friday, 3 May 1963, at 7:45 p.m., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (40): R. P. Allen, J. R. Anderson, P. H. Arnaud, Jr., R. M. Bohart, D. J. Burdick, J. A. Chemsak, M. M. Collins, H. V. Daly, D. G. Denning, J. Drew, J. G. Edwards, W. E. Ferguson, J. W. Fujii, R. H. Goodwin, H. Hacker, P. A. Harvey, M. E. Irwin, D. Jamieson, D. H. Janzen, B. Keh, D. H. Kistner, R. L. Langston, H. B. Leech, E. G. Linsley, C. D. MacNeill, Lois and C. W. O'Brien, J. A. Powell, F. C. Raney, D. C. Rentz, Judy M. Ross, T. N. Seeno, C. Slobodchikoff, J. Snell, G. I. Stage, L. A. Stange, J. W. Tilden, Catherine Toschi, A. Willink, V. B. Whitehead.

Visitors present (31): Barbara Barr, Margaret Bohart, Chestina Bolton, Mary A. Chemsak, Barbara B. Daly, Loretta Denning, Carol Drew, T. L. Erwin, L. Etzel, W. A. Foster, G. W. Frankie, Judy Froebe, R. E. Hall, Kathleen A. Hall, Karen Janzen, Alzada C. Kistner, James Litsinger, LaVerne Magarian, Doug Miller, Kellie O'Neill, Irene Pogojeff, J. E. Prine, Mr. and Mrs. A. Raske, J. Snell, Kaye N. Stage, M. W. Stimmann, M. Tauber, V. Vesterby, R. L. Westcott, Mrs. A. Willink.

The minutes of the meeting held 15 February 1963 were summarized.

Three new members were elected: J. E. Dibble, M. Kattoulas, and C. S. Koehler, Berkeley, California.

Introduced European cerambycid.—DR. J. A. CHEMSAK presented the following note on a female specimen of a European cerambycid, *Plagionotus arcuatus* (L.) which was collected alive in Wilmington, Los Angeles County, California, 12 April 1963, by B. P. Dunn on the roof of a six-story building. This species has been reported by Duffy (1953, Monograph of the immature stages of British and imported timber beetles, British Museum (Nat. Hist.), p. 225) as frequently being encountered in England in timber imported from the continent. The larval damage detracts somewhat from the value of the timber of hardwoods as *Quercus*, *Fagus*, *Prunus*, etc. As far as is known, this beetle is not established in this country and entry is probably through lumber or imported furniture.

Ladybird beetles mating at high elevations.—DR. J. G. EDWARDS exhibited living specimens of ladybird beetles and gave the following information on their capture. Specimens of *Hippodamia convergens* and *Coccinella transversoguttata* were collected 28 April 1963, by Hal Kanzler on top of six to eight feet of snow at Swiftcurrent Pass in Glacier National Park, Montana. At 7,500 feet elevation, Hal found about one ladybird beetle for every 25 square feet. The beetles were crawling on the snow. Also on the snow was one *Aphodius fimetarius* and two ichneumon wasps. This high pass is nine miles from the road, and is seldom visited by climbers this early in the season because of avalanche danger. It is a valuable record of occurrence of ladybirds at this elevation so early in the season, and it is hoped that similar observations will be made by other mountain climbers in the northern Rockies this spring. Evidently the beetles migrate to the mountain-tops very early in the year, mate there (many were mating on Swiftcurrent Pass), then disperse to the fields below for feeding during May and June. They again seek the summits in July, with their bodies rich in lipoids, but mating is scarce at that time. Unless trapped by early snows, they soon migrate into the valleys

4,000 feet below, and overwinter there beneath a heavy blanket of snow. This biological cycle is apparently not the same as that of ladybird beetles in warmer climates in Oregon and California.

***Pidonia scripta* (LeConte) from oak bark.**—MR. D. C. RENTZ described a log of the Coast Live Oak, *Quercus agrifolia* Nee, some thirty feet long and two feet in diameter, which was found in early 1957 in the hills near Millbrae, San Mateo County, California. The bark, measuring an inch and a half thick, showed signs of insect infestation and several slabs were placed in a cage. On 23 March 1957, a small yellowish cerambycid emerged which was identified as *Pidonia scripta* (LeConte) by H. B. Leech. This appears to be the first host record for this species, which is rare in the San Francisco Bay region and is not known from much farther south. *P. scripta* was described from Vancouver Island, and is common there as well as in the interior of British Columbia, where it occurs in numbers on the flowers of wild rose. Mr. Leech pointed out that Swaine and Hopping remarked on the coarse elytral punctation of examples from just north of San Francisco (1928, *The Lepturini of America north of Mexico*. Part I. Natl. Mus. Canada, Bull. 52, p. 19). Oaks occur over only part of the known range of *P. scripta*. If the local population is not specifically distinct, the species must have more than one host.

The principal speaker of the evening was DEAN E. GORTON LINSLEY, University of California, Berkeley. His illustrated lecture was on "Some mimetic associations of lycid beetles and their models."

A coffee social in the entomology rooms followed the meeting.—HOWELL V. DALY, *Secretary*

TWO HUNDRED AND EIGHTY-SIXTH MEETING

The 286th meeting was held Friday, 18 October 1963, at 7:45 p.m., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (66): R. P. Allen, J. R. Anderson, C. Armin, P. H. Arnaud, Jr., J. Birchim, R. M. Bohart, D. J. Burdick, L. E. Caltagirone, D. Cavagnaro, J. A. Chemsak, M. M. Collins, H. V. Daly, R. L. Doutt, J. G. Edwards, T. Erwin, W. E. Ferguson, D. Furman, R. H. Gonzalez, R. H. Goodwin, A. A. Grigarick, K. S. Hagan, P. A. Harvey, W. G. Iltis, E. R. Leech, H. B. Leech, B. Keh, B. B. and E. L. Kessel, D. H. Kistner, C. S. Koehler, G. Kuno, W. H. Lange, R. L. Langston, T. H. Lauret, J. F. Lawrence, C. D. MacNeill, J. W. and Jane MacSwain, H. L. McKenzie, A. S. Menke, G. G. Moore, Jr., W. D. Murray, W. H. Nutting, Lois B. and C. W. O'Brien, L. R. Parks, J. A. Powell, F. Raney, D. C. Rentz, C. J. Rogers, E. S. Ross, Judy Ross, F. E. Skinner, C. Slobodchikoff, G. I. Stage, L. A. Stange, W. Stanger, R. E. Stecker, W. A. Steffan, Y. Tanada, P. E. Turner, Jr., Nancy Twomey, R. L. Usinger, R. L. Westcott, A. Willink.

Visitors present (101): Mrs. J. R. Anderson, Barbara Barr, Margaret Bohart, Mrs. H. C. Brodahl, R. M. and Brenda L. Brown, R. W. Browe, Claudia Burnett, Aileen Cabral, R. L. Campbell, W. Chase, Mrs. J. A. Chemsak, Donna Lou and Patrick R. Craig, Sandy Cunningham, Rachel Dagovitz, Barbara B. Daly, H. V. Davis, D. M. Deebrinen, Mr. and Mrs. J. T. Doyen, R. E. Eastwood, Carol Eastwood, Shozo Ehara, T. C. Emmel, P. C. Engelder, LaVerne Erwin, L. Etzel, G. H. Feinberg, Stephenie, Rick and Robin Ferguson, A. and Madeline Finlay, W. Foster, Judy

Froeber, Mrs. D. P. Furman, B. Gabriel, Celeste Green, Barbara Grigarick, R. E. Hall, Jacqueline L. Hall, P. M. Keyes, U. and Alain Kinet, Mrs. D. L. Kistner, R. Klieforth, Mrs. W. H. Lange, Mrs. R. L. Langston, Deirdre Lee, Virginia and Bertha Leech, Mr. and Mrs. H. Lloyd, J. B. MacKenyi, M. Marquis, Mrs. H. L. McKenzie, Karen Menke, A. Miller, D. Miller, Mrs. C. Moore, G. and Else Mosheim, Mr. and Mrs. R. Murill, Francis Murray, J. Nakata, M. and Donna Oleson, P. and Sandra Opler, A. K. Ota, Pat Paul, J. Payne, T. Payne, R. L. and Luida J. Penrose, J. H. Poorbaugh, Kathleen Rentz, Mr. and Mrs. R. E. Rice, E. R. Sanderson, J. Shimizu, J. Schosanski, E. M. Stafford, Kaye N. Stage, Phyllis Stecker, W. J. and Dianne Steele, L. Stipe, Billie Tanson, Mr. and Mrs. Ronald Van Til, Mr. and Mrs. W. J. Turner, Mrs. R. L. Usinger, E. W. Valentino, D. S. Verity, P. S. Welles, Lila Willink, Barbara A. Wilson.

The minutes of the meeting held 3 May 1963 were summarized.

Eleven new members were elected: J. Birchim, Independence, California; G. M. Buxton, Sacramento, California; T. L. Erwin, L. Parks, and R. E. Stecker, San Jose, California; G. Kuno and P. E. Turner, Jr., Berkeley, California; R. L. Westcott and J. L. Reed, Davis, California; N. Ueshima, Mie, Japan; A. Willink, Tucuman, Argentina.

Appointments to two committees were made: nominating, A. A. Grigarick, Chairman, J. G. Edwards, and D. D. Jensen; and auditing, W. H. Lange, Jr., Chairman, and C. S. Koehler.

Rare butterflies from Montana.—DR. J. G. EDWARDS exhibited specimens and offered the following information on three individuals of the rare *Boloria alberta* Edwards which were collected in Glacier National Park, Montana. So far as is known this is the first record of its occurrence in continental United States, although it is recorded from high barren ridges in Alberta. He found them from 7600 feet to 8500 feet, on three different peaks, but could not associate food plants or observe oviposition.

The principal speaker of the evening was DR. EDWARD S. ROSS, California Academy of Sciences. His illustrated lecture was on "Insect collecting in the Indo-Australian Region."

A coffee social in the entomology rooms followed the meeting.—HOWELL V. DALY, Secretary

TWO HUNDRED AND EIGHTY-SEVENTH MEETING

The 287th meeting was held Friday, 22 November 1963, at 7:45 p.m., in the Morrison Auditorium of the California Academy of Sciences, San Francisco, with President Bohart presiding.

Members present (21): J. R. Anderson, P. H. Arnaud, Jr., J. Birchim, R. M. Bohart, H. V. Daly, J. G. Edwards, W. E. Ferguson, R. H. Gonzalez, P. D. Hurd, Jr., C. S. Koehler, H. B. Leech, C. D. MacNeill, J. A. Powell, E. S. Ross, C. Slobodchikoff, F. E. Skinner, W. A. Steffan, Catherine Toschi, P. E. Turner, Jr., R. L. Usinger, A. Willink.

Visitors present (16): Margaret Bohart, Barbara and Diane Daly, R. E. Eastwood, Mrs. J. G. Edwards and Janie, R. E. Hall, J. B. Hoy, J. H. Oliver, J. H. Poorbaugh, Mr. and Mrs. A. Raske, Fernando Dias de Airla Sires and Luia M. M. de Airla Sires, M. Tauber, Lila Willink.

The minutes of the meeting held 18 October 1963 were summarized.

One new member was elected: N. Powers, La Mesa, California.

The reports of the Treasurer and auditing committee were read by President Bohart. The financial records of the past year were in order. Both reports were accepted by the Society.

J. G. Edwards, member of the nominating committee, presented the names of the nominees, and the following people were elected as Society officers for 1964: President, Jerry A. Powell; Vice-President, W. E. Ferguson; Secretary, Carlton S. Koehler. The position of Treasurer was left vacant.

President Bohart, on behalf of the Society, expressed appreciation to **Dr. Robert C. Miller** who has served as Treasurer for the Society for the past twenty years. Dr. Bohart recalled the many important duties assigned to Dr. Miller and also noted the valuable services of **Mrs. Hawley**, Dr. Miller's secretary, who has handled many of the details of the office.

Dr. R. L. Usinger, Chairman of the Publication Committee, announced with regret, the resignation of **Dr. Paul D. Hurd, Jr.**, who has served faithfully as Editor of the *Pan-Pacific Entomologist* for fourteen years. In extending the Society's appreciation to Dr. Hurd, Dr. Usinger reviewed the tasks of the editor and the heavy burden placed on the time of the editor.

Search for information on monograph by R. H. Stretch.—DR. C. D. MACNEILL called attention to a request communicated to him by F. M. Brown of Fountain Valley School, Colorado Springs, Colorado. Mr. Brown, in connection with his researches on the types of butterflies described by W. H. Edwards, has studied the correspondence between Richard Harper Stretch and Herman Strecker. This revealed that Stretch had begun, in 1882, a monograph of the Bombycidae. By 1884 at least 350 text pages and many plates had been printed. This work was never completed, but eleven of the plates were published in 1906 in the Journal of the New York Entomological Society. Mr. Brown requests information on any of the unpublished signatures or plates of this work which may exist in institutional or private libraries.

***Xylocopa (Neoxylocopa) varipuncta* nesting in driftwood in Mexico.**—DANIEL H. JANZEN submitted the following note which was read to the Society by R. Thorp: "While collecting on the beach at La Cruz, Sinaloa, Mexico, an angiosperm driftwood log (6 feet long by 8 inches in diameter) was found to have two *Xylocopa* entrance holes. It was about twelve feet back from the high tide line, about one foot above the high tide level, and flat on the sand. When broken open it was found to contain a large termite colony and two eight inch long *Xylocopa* tunnels, the ends of which had been engulfed by the termite galleries. A single male carpenter bee, *X. varipuncta* Patton (det. P. D. Hurd, Jr.), was in the log. While working on the log another male came from inland; it was collected while attempting to enter an entrance hole and a single female of the same species was taken in the same manner a few minutes later. The outside of the log was sand and wave polished and very hard. The entrance holes were sharp and appeared to have been made since the log was washed up; there were two shallow pits where the bee had given up after starting a hole.

"It is quite possible that the termites had destroyed the empty brood cells after the three above mentioned bees had emerged; the remaining tunnels showed no evidence of having served as brood cells and their ends had been removed

by the termites. The log was found at the end of the dry season (June 1962) and it is likely that it would have become wave washed during the summer storms and rendered unsuitable for a nest site. It is probable that temporary nest sites of this nature are the rule in areas that have a long rainy season during which dead wood is quickly destroyed by wood boring insects and fungi. Therefore, it should not be surprising to find carpenter bees nesting in what appear to be precarious conditions; they may be the only sites available."

The principal speaker of the evening was DR. G. A. H. McCLELLAND, University of California, Davis. His illustrated lecture was on "Recent developments in mosquito genetics."

A coffee social in the entomology rooms followed the meeting.—HOWELL V. DALY,
Secretary

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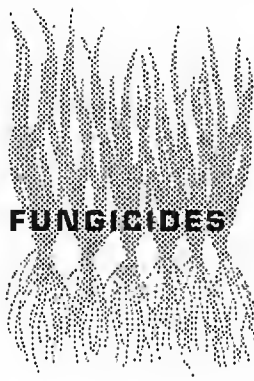
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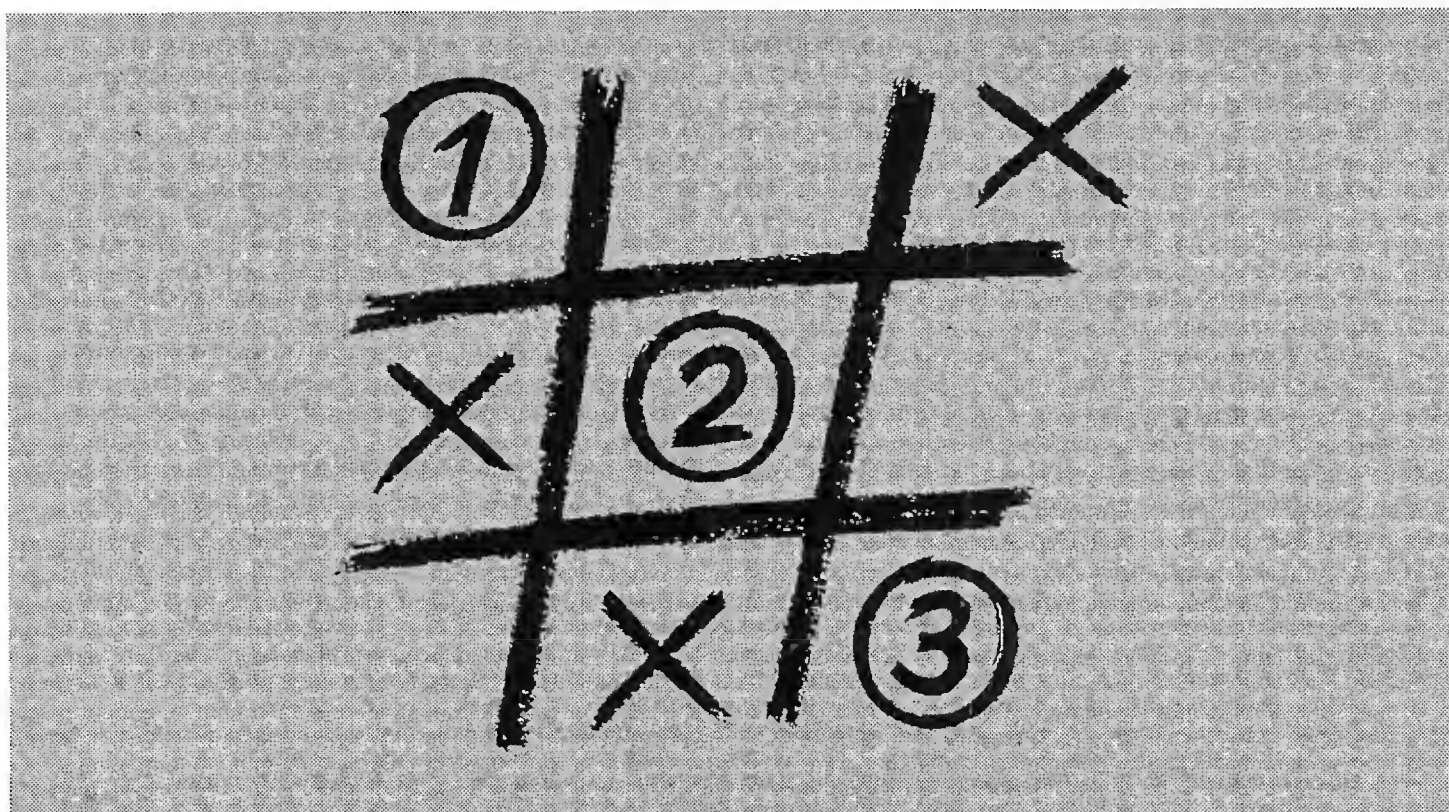
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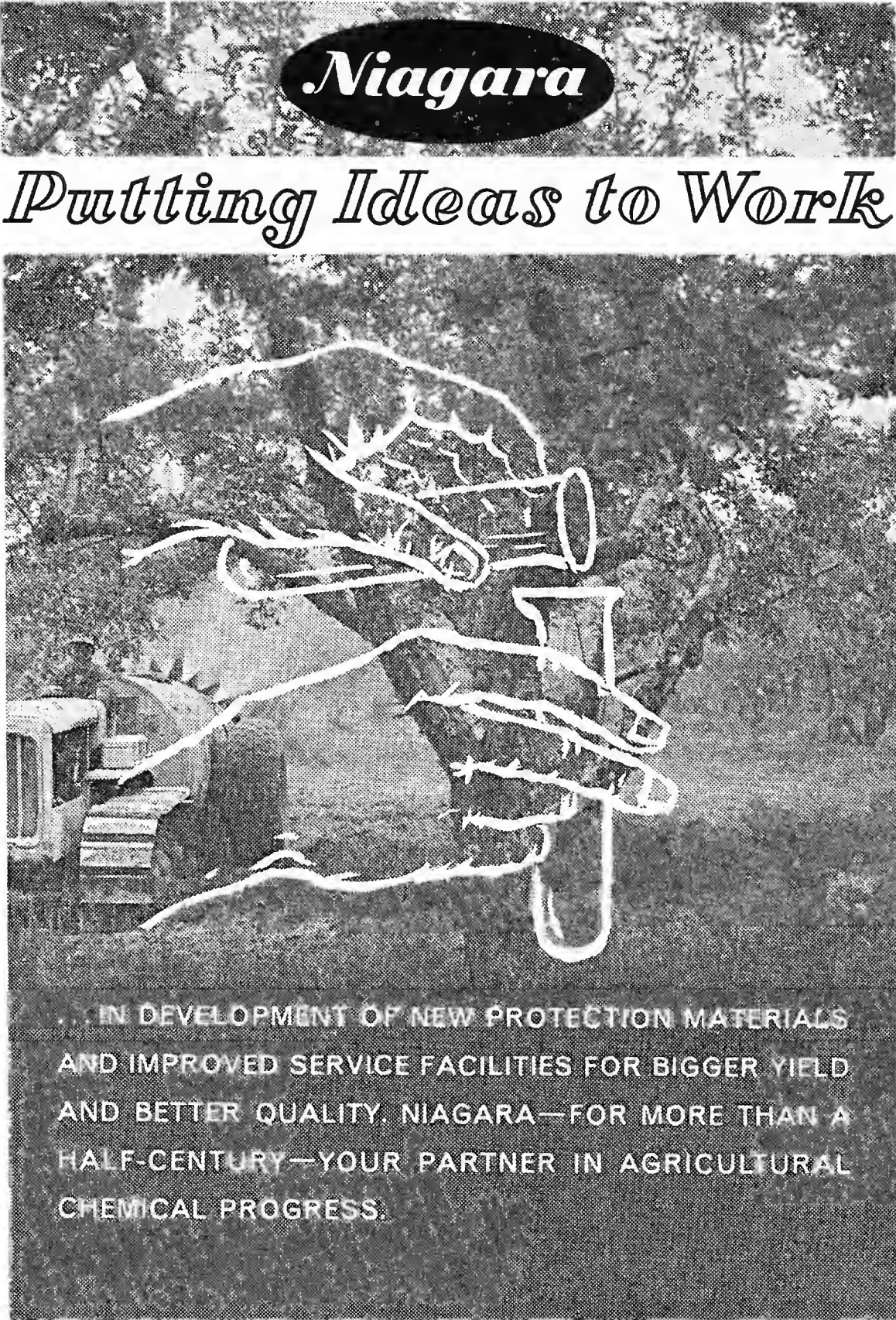
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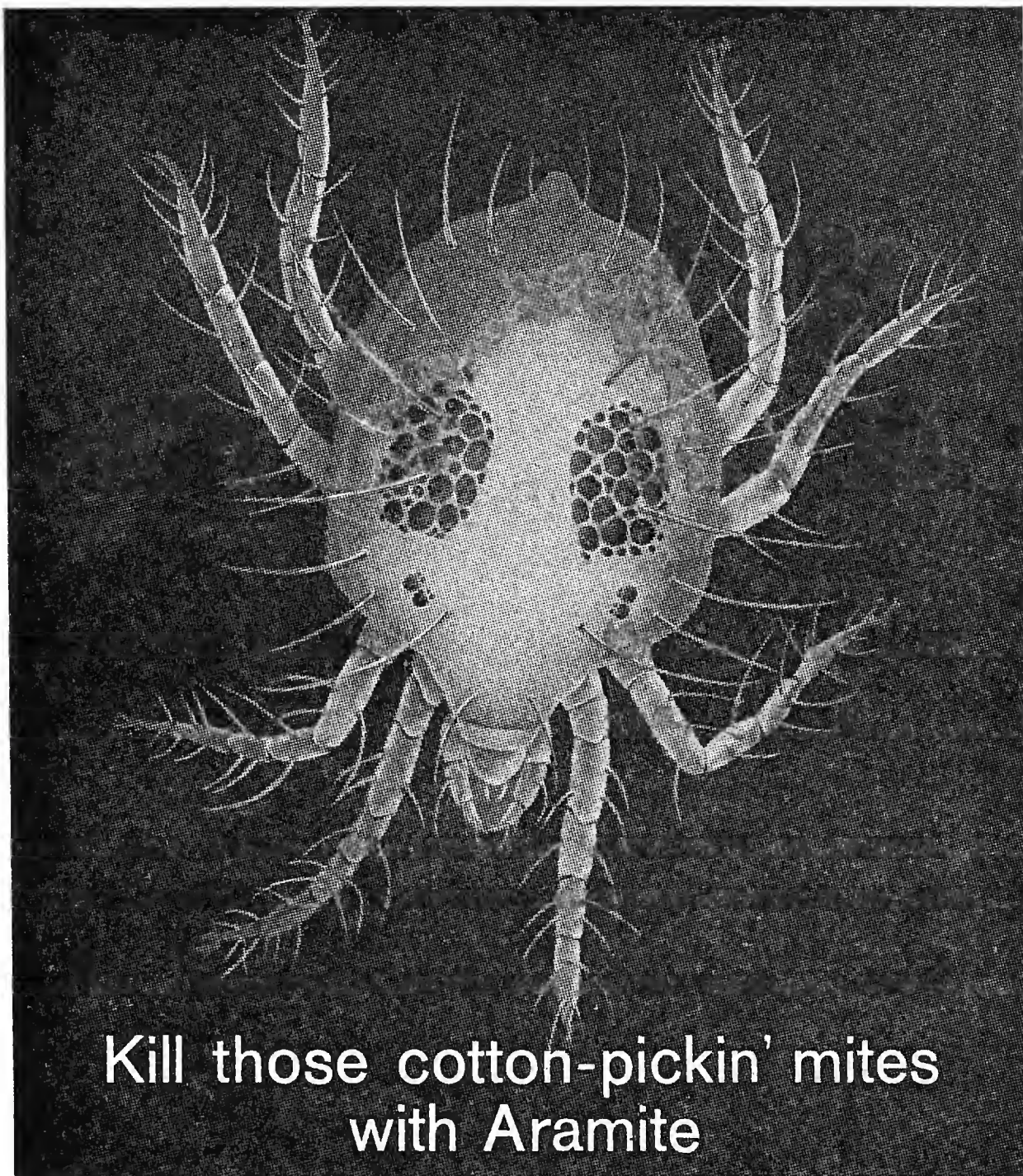
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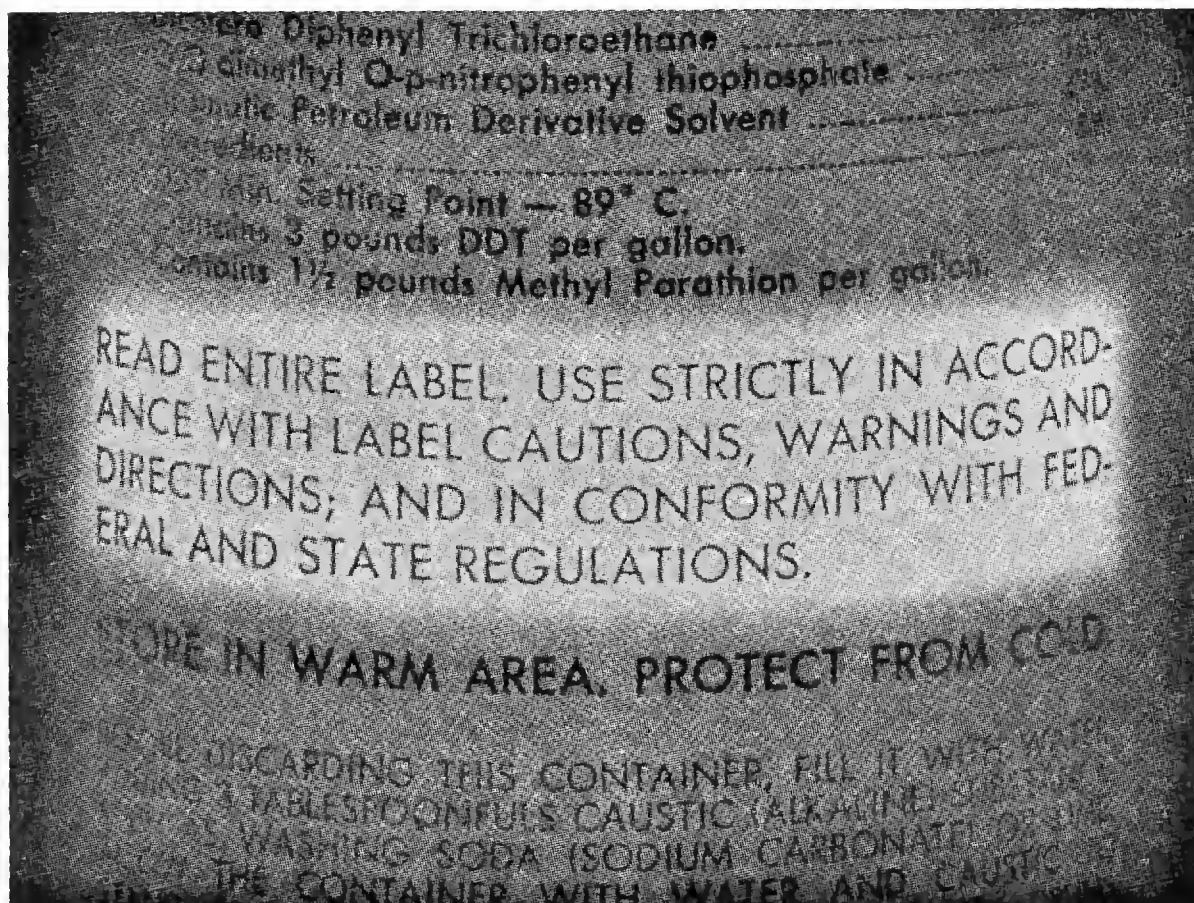
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Title of Publication: The Pan-Pacific Entomologist

Frequency of Issue: Quarterly (January, April, July, October)

Location of Office of Publication, Business Office of Publisher, Publisher and Owner: Pacific Coast Entomological Society, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118.

Editor: Dr. Howell V. Daly, 112 Agriculture Hall, University of California, Berkeley, California 94720.

Managing Editor and Known Bondholders or other Security Holders: none.

This issue mailed 26 June 1964.

Second Class Postage Paid at Lawrence, Kansas, U.S.A.

THE ALLEN PRESS PRINTED IN U.S.A. LAWRENCE, KANSAS

The Pan-Pacific Entomologist

Vol. 40

APRIL 1964

No. 2

Host Plants, Population Density, and Parasites of Two Species of Jumping Plant Lice

(Homoptera : Psyllidae)

MONT A. CAZIER

*University of California, Berkeley*¹

This small family of homopterous insects is widely distributed throughout the temperate portions of the world. Several European species have been accidentally introduced into North America where they have flourished and become important economic pests. The pear psylla (*Psylla pyricola* Förster) and the apple sucker (*Psylla mali* Schmidberger) are two examples of such introductions. A native species, the potato or tomato psyllid *Paratrioza cockerelli* (Sulc), is important in that it injects a phytotoxic secretion that causes yellows in some solanaceous crop plants. Many species secrete honeydew and wax, others form galls, and some cause leaf curl on various plants. The bulk of the species is not, however, considered to be economic pests even though both nymphs and adults feed on plant juices. The present paper is concerned with two species, *Trioza collaris* Crawford and *Kuwayama medicaginis* (Crawford), which have not yet been found to be of economic importance although adults of the latter species have been found on alfalfa, *Medicago sativa* L.

Trioza collaris was originally described from California where it has been collected in the following counties: Los Angeles, Inyo, Santa Clara, Santa Cruz, San Francisco, and Contra Costa. Tuthill (1943) gives its distribution as California, Arizona, New Mexico, and Texas. Klyver (1932) collected a number of last instar exuviae on *Baccharis pilularis*, and Tuthill (1943) reported that some of his specimens had been labeled as being collected on *Baccharis viminea* DC. Jensen (1963, *in litt.*) has collected both adults and nymphs on *Baccharis pilularis* at Grizzly Peak, Berkeley, California, 26 March 1948. He further reports that on this date one adult had just emerged and had soft, not fully expanded wings.

Kuwayama medicaginis (Crawford) was originally described from Colorado and subsequently reported from El Centro, Imperial County,

¹ Department of Entomology and Parasitology. Currently Visiting Professor of Zoology, Arizona State University, Tempe, Arizona. This project was supported in part by National Science Foundation Grant GB-379.



California. Tuthill (1943) reports specimens from numerous localities in Arizona, New Mexico, and Texas. Caldwell (1941) recorded adults from Iguala, Guerrero, Mexico, 11 September 1939 and from Santa Engracia, Tamaulipas, Mexico, 4 November 1938 (De Long and Caldwell). Crawford (1914) reported that his California specimens were taken on alfalfa, *Medicago sativa* L., and Tuthill (1943) states that it is still in question as to whether this is the true host. Jensen (1963, *in litt.*) reports that he and L. D. Christenson collected adults from alfalfa at Mesilla, New Mexico, 4 December 1939; from Russian thistle, *Salsola kali* L., at La Luz, New Mexico, 12 December 1939; and from creosote bush, *Larrea tridentata* (DC.) Coville, at Sentinel, Arizona, 20 December 1939. Jensen (1960, *in litt.*) also mentions that Dr. Paul Oman found the adults to be abundant on tar bush, *Flourensia cernua* DC., between Marathon and Sanderson, Texas, January 1942. No nymphs or exuviae were in evidence. Until the present time the true host of this species has remained unknown.

TRIOZA COLLARIS CRAWFORD

The following observations on this species were made at a location 2 miles northeast of Portal, Cochise County, Arizona, on the foothills of the Chiracahua Mountains at 4,700 feet. The immediate site was in a dry, earthen tank or catch basin that had about 40 shrubs of *Baccharis glutinosa* Pers. along the margins, primarily on the north and east sides, inside the tank. At the time the studies were made, August 1960 to January 1961, all the plants were healthy and either in full bloom or had the old blossoms still on the plants.

The adults of *Trioza collaris* were first noticed on the flowers in August 1960 but it was not until 12 September that they figured in another project and became the subjects of more detailed observation. On this date a pair of Wilson's (Pileolated) Warblers, *Wilsonia pusilla pileolata* (Pallas), moved into the area and fed on the adults, primarily on three shrubs, for a period of several days. On 22 October samples of the flowers were cultured and 2 days later the adult psyllids began to emerge and continued to do so until the middle of December. By 10 January 1961 very few adults were in evidence in the field.

←

EXPLANATION OF FIGURES

Fig. 1. (upper photograph) Adult *Trioza collaris* Crawford on flower head of *Baccharis glutinosa* Pers. Photo by Marjorie Statham. Fig. 2 (lower photograph) Nymphs of *Kuwayama medicaginis* (Crawford) *in situ* in opened flower head of *Flourensia cernua* DC. Photo by Marjorie Statham.



Nymphal parasites began emerging from these cultures on 29 October, or 7 days after being cultured, and continued to do so until the middle of December. Dr. B. D. Burks has described these as *Tetrastichus psyllaephagus* Burks belonging to the family Eulophidae. Jensen (1957) records five identified and three undetermined species of *Tetrastichus* as known parasites of eight determined and two undetermined species of the psyllid genus *Trioza*, six of which are from North America: *Tetrastichus dyrus* Burks on *Trioza* sp. in Montana, *Tetrastichus gelastus* Burks on *Trioza* sp. in Florida, *Tetrastichus triozae* Burks on *Trioza albifrons* Crawford and *T. beameri* Tuthill in California, *Tetrastichus* sp. on *Trioza bakeri* Crawford in California, and *Tetrastichus* sp. on *Trioza maura* Förster in California. To this list we can now add *Tetrastichus psyllaephagus* on *Trioza collaris* in Arizona. The *Tetrastichus psyllaephagus* parasite overwinters in both the pupal and adult stages inside the last instar nymphal skins of *Trioza collaris* in the dried-up flower heads of *Baccharis glutinosa*. Several dried flower heads containing defunct nymphs of *Trioza collaris* were collected on 8 February 1963. The *Tetrastichus* adults began to emerge immediately and continued to do so until 26 February under laboratory conditions. Both pupae and adults of the wasp were in the *Trioza collaris* nymphal skins when they were first collected, and the pupae were already heavily pigmented.

In the young nymphs of *T. collaris* it was impossible to detect which individuals were parasitized. However, in the last instar the nymphs were immobilized and usually fastened to the substrate, and the developing parasite could be seen inside. Emergence from the nymphal skin was accomplished through an irregular hole cut by the adult wasp through the dorsum, occasionally the venter, of the abdomen near the apex. The amount of time required for the adult wasp to emerge after detection varied from 11–14 days under laboratory conditions.

The eggs of *Trioza collaris* are laid beneath the closely adhering phyllaris (bracts of the involucre, in Compositae) and are probably placed in this position by the females inserting the short, sharp ovipositor through a phyllary. They are oblong, light green in color, and are arranged radially with the inner end stuck to the substrate next to the ends of other eggs in the cluster. Of several hundred egg clusters examined

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EXPLANATION OF FIGURES

Fig. 3. (upper photograph) Inflorescence of *Baccharis glutinosa* Pers. containing an estimated 5,446 nymphs and eggs of *Trioza collaris* Crawford. Photo by Marjorie Statham. Fig. 4. (lower photograph) Flower head of *Flourensia cernua* DC. showing wax secreted by nymphs of *Kuwayama medicaginis* (Crawford). Photo by Marjorie Statham.

all had six eggs except one, which had only two. The number of egg clusters per flower head varied from 0–6 and in all cases nymphs in varying stages of development were already present. In one with five clusters (30 eggs) there were already 80 nymphs present. In another with six clusters (36 eggs), 21 nymphs were already present (Table 1).

The nymphs are located inside the flower heads, head downward between the florets with their long threadlike mouthparts inserted in the receptacle of the flower head. The larger nymphs were near the surface of the flower head where the tips of their abdomens could be seen and the small ones were hidden beneath. Maturation takes place in the flower head, and with the emergence of the adult the cast nymphal skin ends up on top where it is easily dislodged. They evidently do not kill the flowers even when in large concentrations, but they may be responsible for discoloration and general weakening. Unlike some of the other Psyllidae the nymphs of this species have no waxy or cottony secretion. Copulation has been observed to take place on the flowers, leaves, and stems of the plants. They evidently overwinter as adults in protected portions of the plant, including the old flower heads, and numerous specimens were collected in these situations between 8–10 February 1963. No eggs were found in the old, dried flowers or on the leaves.

On 29 and 30 October 1960, ten flower heads were selected at random from ten different inflorescences on ten different bushes and their contents (eggs and nymphs) counted. The results of these counts (Table 1) are interesting from a population standpoint and probably represent a

Table 1.—Population density of eggs and nymphs of *Trioza collaris* Crawford in ten flower heads from ten different inflorescences from ten different bushes of *Baccharis glutinosa* Pers., 29 and 30 October 1960.

Number	Flower Head Diameter in mm	Number of Nymphs	Number of Egg Clusters	Number of Eggs	Total Nymphs and Eggs per Flower Head	Percentage of Eggs	Percentage of Nymphs
1	4 × 6	24	2	12	36	33.3	66.7
2	4 × 4	34	3	18	52	34.6	65.4
3	3 × 4	7	0	0	7	0	100.0
4	5 × 5	80	5	30	110	27.3	72.7
5	4 × 6	41	2	12	53	22.6	77.4
6	6 × 7	21	6	36	57	63.2	36.8
7	6 × 6	20	4	20	40	50.0	50.0
8	6 × 7	62	3	18	80	22.5	77.5
9	7 × 7	90	3	18	108	16.7	83.3
10	7 × 7	88	1	6	94	6.4	93.6

minimum figure rather than maximum since no adult counts were made. The individual flower heads were found to contain an average of 63.7 nymphs and eggs. There was an average of 85.5 flower heads per inflorescence which means a population of 5,446 nymphs and eggs per inflorescence. The bushes were found to have an average of 100 inflorescences each or a population of 544,600 psyllids per bush. Since there were 40 *Baccharis glutinosa* shrubs present, it indicates a population of about 21,784,000 nymphs and eggs of *Trioza collaris* on these 40 plants. This is exclusive of the many thousands of adults that were also present at this time. The sample of ten also shows that of this number about 73% were nymphs and 27% eggs, thus indicating an earlier period of maximum oviposition.

KUWAYAMA MEDICAGINIS (CRAWFORD)

The following observations on *Kuwayama medicaginis* were made on the same plot as described under *Trioza collaris* and also in an area 1 to 2 miles east of Portal, Arizona. In these areas the breeding host is *Flourensia cernua* DC., as it probably is in Texas, and the nymphs are found in the sticky flower heads. Their presence was first noticed on 4 December 1960 when the white, waxy, nymphal secretion was seen in the tops of the flower heads. The nymphs were arranged in a manner similar to those of *Trioza collaris*, with the older ones near the surface and the younger underneath. No eggs could be found and, although not counted, the population density was much lower than in *Trioza collaris*, possibly because of spatial competition. A high percentage of the flower heads was infested by the larvae of a fly (*Trupanea* sp.) and the larvae of a weevil, *Smicronyx profusus* Casey, which occupied most of the center of many of the flowers.

On 4 December 1960 many flower heads were cultured and the adults of *Kuwayama medicaginis* began emerging from them on 6 December. These continued to emerge until early February 1961. On 10 January 1961 nymphal parasites began emerging and continued to do so until early February. Dr. B. D. Burks determined these as *Psyllaephagus trioziphagous* (Howard), an encyrtid parasite previously known only from *Trioza diospyri* (Ashmead). This parasite overwinters in the pupal and adult stages inside the last instar nymphal skins of *Kuwayama medicaginis* in the dead, persistent flower heads of *Flourensia cernua*. The adult wasps began emerging immediately from dried flowers collected on 8 February 1963 and continued to do so until 29 March 1963 under laboratory conditions. Most of them emerged within 10 days of being collected. Emergence from the nymphal skins is accomplished through a small, irregular hole cut by the adult parasite through the dorsum, oc-

casionally through the venter, of the abdomen near the apex. An anthocorid (Anthocorinae) predator was also found in all its nymphal stages, as well as eggs and adults, feeding on the nymphs of *Kuwayama medicaginis*. Dr. R. C. Froeschner was unable to determine the genus or species since the subfamily is badly in need of revision. We were unable to locate the eggs of *Kuwayama medicaginis* and may have been too late in the season for them.

ACKNOWLEDGMENTS

The writer would like to express his sincere appreciation to Dr. D. D. Jensen, Department of Entomology and Parasitology, University of California, Berkeley, for his assistance, cooperation, and encouragement which made this paper possible. Grateful acknowledgment of assistance is also extended to Dean E. Gorton Linsley, Dr. Ray F. Smith, and Dr. Paul D. Hurd of the University of California, Berkeley; Dr. Karl V. Krombein, Dr. B. D. Burks, Dr. W. H. Anderson, and Dr. R. C. Froeschner of the United States Department of Agriculture, Entomological Research Division, Beltsville, Maryland. The writer is indebted to Miss Marjorie Statham, Department of Entomology, American Museum of Natural History, New York, and to Mr. Martin A. Mortenson of the Department of Entomology and Parasitology, University of California, Berkeley, for the excellent photographs.

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**Biological Observations on *Melissodes* (*Eumelissodes*)
*pallidisignata***

(Hymenoptera : Anthophoridae)

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Among the eucerine genera of the Western Hemisphere, *Melissodes* Latreille is the largest, containing 122 species (LaBerge, 1956a, 1956b, 1957, 1961). With the exception of flower records, little biological information on the genus has been published. Observations have been made on the sleeping habits of males of various species by a number of authors: Banks (1902) on *M. bimaculata* (Lepeletier); Mathewson and Daly (1955) on *M. perplexa* Cresson (= *denticulata* Smith); LaBerge (1956a) on *M. communis communis* Cresson; Evans and Linsley (1960) on *M. paroselae* Cockerell and *Melissodes* species near *confusa* Cresson; Linsley (1962) on *M. paroselae* and *M. tristis* Cockerell; LaBerge (1961) on *M. confusa* Cresson; and Chemsak and Thorp (1962) on *M. robustior* Cockerell. Most of the published accounts of female habits provide only fragmentary data on nest structure, nest site behavior, and parasite relationships. The following authors present information on these activities, some partially and others in detail: Ashmead (1894) on *M. bimaculata*; Graenicher (1905) on *M. trinodis* Robertson; Rau (1922) on *M. agilis* Cresson; Hicks (1926) on *M. mizeae* Cockerell (= *menuachus* Cresson) and *M. subagilis* (Cockerell); Scullen (1928) on *M. mysops* Cockerell (= *rivalis* Cresson); Hicks (1936) on *M. timberlakei* Cockerell; Linsley (1946) on *M. timberlakei*; Janvier (1955) on *M. sexcincta* (Lepeletier); MacSwain (1958) on *M. robustior*; Michener and Lange (1958) on *M. nigroaenea* (Smith); and Hurd and Linsley (1959) on *M. composita* Tucker.

According to LaBerge (1961), *M. pallidisignata* Cockerell is a highly variable species which could be separated into two to six subspecies depending upon the characters used. Our studies are concerned with the melanic coastal populations of which specimens have been seen from Monterey to Mendocino counties of California. It is not the purpose of this paper to attempt to solve the taxonomic position of these populations, except to point out that the coastal California form is structurally, as well as chromatically, separable from other specimens assigned to the same species. In addition, the collection dates for the coastal populations range from late June into August, while dates for other populations, such as those from Turlock, Antioch, and southern California, extend from August through October.

A nest site of *M. (E.) pallidesignata* was first discovered at Rockaway Beach, Pacifica, San Mateo County, California in late June 1961. However, our main observations were not initiated until 11 July 1963, and subsequently a second nest site was found on the J. Kehoe Ranch near McClure's Beach, Marin County.

The Rockaway Beach nest site is located on a low, flat bluff about 30 yards from the ocean and occupies an area of about 40 by 25 feet. Most of the burrows are concentrated in a bare parking area of about 20 by 15 feet. The nest site is devoid of vegetation except at the periphery. The soil is predominantly sandy with a few stones interspersed. The upper approximately 2 inches are hard and compacted with the underlying layers being less consolidated and more moist. Most of the surface is covered by a thin layer of loose sand. Adjacent to the site are patches of flowering plants, including *Grindelia stricta* DC. and *Erigeron glaucus* Ker.-Gawl., *Hypochoeris radicata* L., and *Clarkia rubicunda* Lindl. Probably more than 100 active bee burrows are present in the parking area as well as burrows of *Bembix*, *Oxybelus*, *Halictus*, two species of *Philanthus*, and *Hesperapis*.

The nest site on the J. Kehoe Ranch occupies an area of approximately 10 by 20 feet in a single-lane dirt road. The site is flat, devoid of vegetation, and the soil is a dark, compacted sand interspersed with numerous small stones. The hard compacted zone extends below the level of the cells. Most of the scattered patches of *Grindelia* are well away from the nest area. On 7 July the slope above the nests contained numerous flowers of *Layia platyglossa* (F. and M.) Gray (C. W. O'Brien, pers. comm.). Only a few scattered plants of *Layia* were present on 16 July, although *Madia gracilis* (Sm.) Keck and numerous other composites were seen in the area.

The initiation of diurnal adult activity of *M. pallidesignata* appears to be governed by prevailing local weather conditions, chiefly the ambient temperature; high coastal fogs and lower temperatures may cause delays of several hours. During the first warm, sunny day of observations, dozens of bees were observed traversing the nest site by 9:30 a.m. (PST); on another cool, foggy day only a single female was seen flying at 11:00 a.m.

Males appear first during the day, visit the nectar sources, and begin cruising the nest site as the females become active. At the nest site they course rapidly about an inch or less over the surface. They attempt mating with both incoming and outgoing females, with the "mating" pair dropping to the ground and coupling for only a few seconds. As female activity begins to decrease most of the males return to the nectar source and some may be seen investigating plugged burrows. A few females

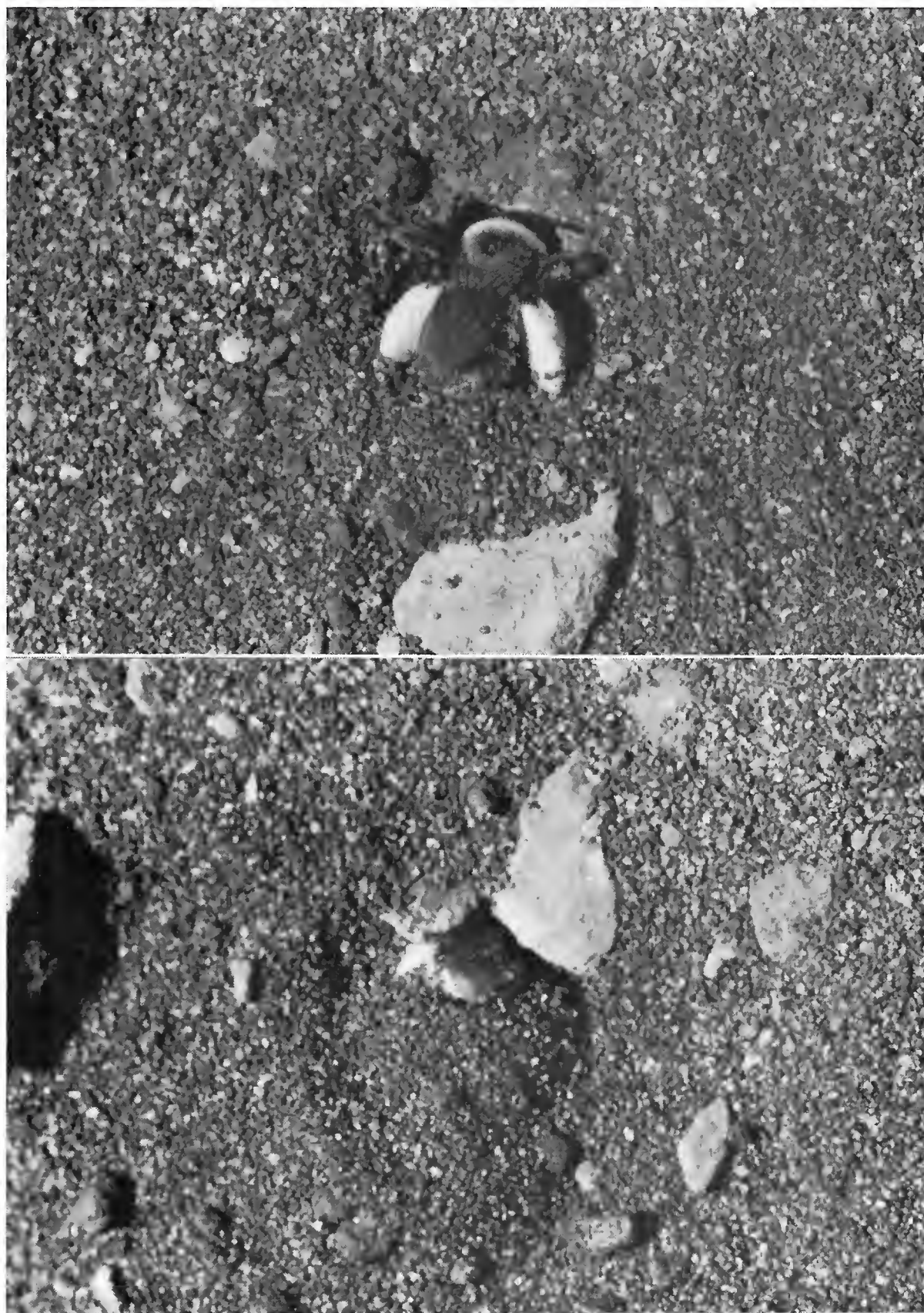
continue to bring in pollen at least an hour after the males cease cruising the nest site.

Males of *M. pallidisignata* were found to spend the night in old or new burrows. Occasionally they could be seen from the entrance, but more often they had to be excavated from the loose sand plug of the tunnels. Males were usually found singly, but occasionally more than one occupied the same tunnel. In one instance, four males and one female were excavated from a single burrow. On the cool, overcast morning of 14 July several males were found in a torpid condition on the flower heads of *Grindelia*. These males may have spent the night there by preference or possibly because they were trapped there by a drop in temperature.

A few females were observed in the act of constructing new burrows. Digging was done with the forelegs and possibly the mandibles. During the process, the female backed from the burrow, walking on the two hind pairs of legs while propelling loose sand behind her with the forelegs. This action continued until the bee had an acentric tumulus extending about 2–3 inches to one side of the entrance. The tumulus is formed from the first inch or two of the excavation. Loose sand dug from this point on remains in the tunnel, forming a plug which is never removed, and through which the female must traverse. Digging behavior of the females was also observable during their attempts to enter their closed burrows. The bee, in trying to locate the entrance, scraped the loose sand with the forelegs, expelling it backwards under the body. Moving backwards she continued kicking sand behind her and forming a trackway about 7–8 cm in length. This action was repeated a number of times until the burrow entrance was found.

The burrows of *M. pallidisignata* are approximately 6–8 mm in diameter, with a linear distance of 15–25 cm, and terminate in a single cell which is 10–15 cm below the surface. The entrance is marked by an acentric tumulus. The burrows angle about 20–30° from the entrance and vary in configuration, some following a more or less direct line to the cell, while others spiral or double back beneath the entrance. The entrance tunnel is plugged with loose sand to within 5–8 cm of the cell. Sand is prevented from entering the cell by an arch-like section near the end of the burrow (Fig. 2). The vertically oriented, oval cell is 7–8 mm in diameter by 13–14 mm in length, and is lined with a thin coat of wax-like material. There is no structural difference between the cell wall and the surrounding soil matrix, thus making it difficult to excavate the cells intact.

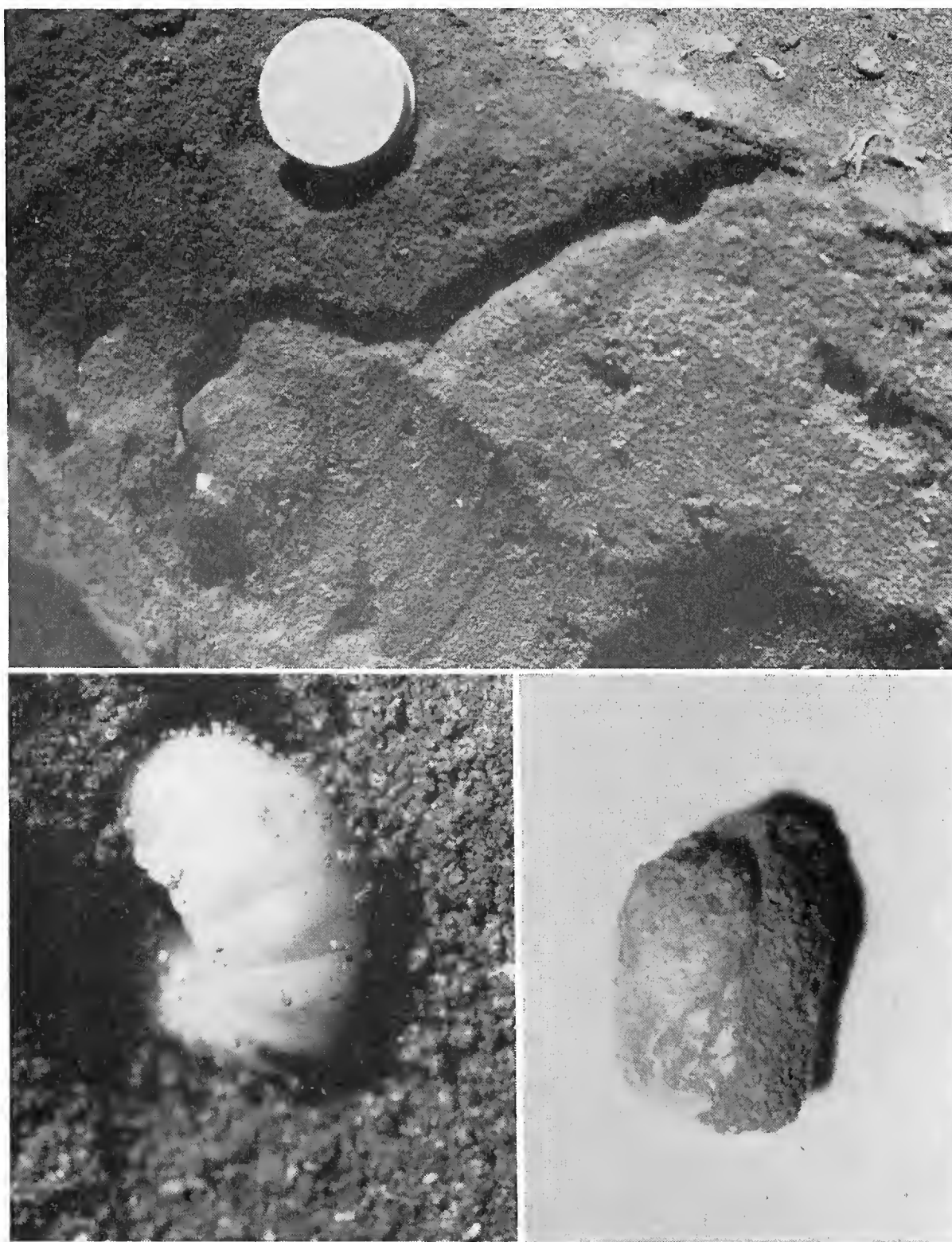
Some pollen-laden females had little or no difficulty in locating the plugged entrances of their burrows. Others spent considerable time



EXPLANATION OF FIGURES

Fig. 1. Upper: Pollen-laden female of *M. pallidesignata* initiating entrance into burrow. Lower: Pollen-laden female burrowing into loose sand of tunnel plug, above the acentric tumulus.

cruising over the nest site, landing frequently and scraping the loose sand with the forelegs as described above. Scraping was particularly apparent in sections of the nest site where we were working and had probably disturbed landmarks. In addition, frequent contacts by cruising males



EXPLANATION OF FIGURES

Fig. 2. Upper: Excavated burrow of *M. pallidisignata* with loose sand plug removed, showing arch-like section above the partially provisioned cell. Lower left: Predefecating larva *in situ*. Lower right: Cocoon and part of the cell, showing feces at the upper end of the cocoon.

interfered with the incoming females. Once the burrow entrance was located, the female burrowed through the loose sand, disappearing in from 4–6 seconds (Fig. 1). When leaving their burrows many females performed short orientation flights which were especially evident prior to the first foraging trip.

M. pallidisignata is an oligoledge of the family Compositae (LaBerge, 1961). At the Rockaway Beach site females were observed to gather pollen from both *Grindelia stricta* DC. and *Erigeron glaucus* Ker.-Gawl. Females were not found on any of the other plants in the area and males were seen on both *Grindelia* and *Erigeron*, indicating that the pollen plants were also the nectar sources. At the J. Kehoe Ranch nest site *Grindelia* was present, but *Erigeron* was absent. On 7 July females were gathering pollen from the abundant *Layia platyglossa*, but activity had decreased markedly by 21 July, and only a dozen or so plants of *Layia* were in evidence (C. W. O'Brien, *pers. comm.*).

Scattered observations on the times of pollen-collecting trips indicated that the bees take 13–25 minutes to gather a pollen load and spend 4–15 minutes in the burrow between trips. One female was timed as follows: 9:31 (PST) entered burrow with pollen load, left in 15 minutes, returned with pollen in 18 minutes, remained in burrow for 11 minutes, returned with pollen in 13 minutes, and left after 8 minutes.

The pollen provisions, which have a moderately strong fermenting odor, fill the bottom one-fourth to one-third of the cell. The egg is laid on the surface and attached to the mass by both ends. Provisions in cells containing eggs appeared to be relatively dry with no surface liquid. The surface appeared to be liquefied, however, in those cells containing early instar larvae. The larvae feed from the top of the food mass, attaining their maximum size just prior to defecation and cocoon spinning (Fig. 2).

Cocoons were excavated at Baker's Beach, San Francisco in the fall of 1959 (well after the active season) and subsequently also at Rockaway Beach. The cocoon is essentially similar to that of *M. robustior* as figured by Linsley, MacSwain, and Smith (1955). It is double walled with more numerous layers of silk at the upper end. The feces are deposited at the upper end of the cell and attached by silk strands to the outer layers of the cocoon (Fig. 2). The fecal-covered cap is tough and retains its shape while the bottom of the cocoon, although double layered, is thin and parchment-like, being easily dented under light pressure.

Excavations on 20 July produced burrows at various stages of construction as well as immature stages ranging from eggs to larvae which had completed their cocoons. The significance of this developmental distribution is not clear since the onset of seasonal activity was not ascer-

tained. It may indicate that the larval development is rapid, that the adults have a long life-span, or both. Numerous cells of previous seasons were also found during the course of our excavation, suggesting that the nesting aggregation is due to the tendency of the bees to nest in the area of their emergence.

DISCUSSION

Several aspects of the biology of *M. pallidesignata* differ from published accounts of other species of the genus. The plugged burrows, which require the pollen-laden females to maneuver through the loose plug in order to reach their cells, have not been reported in the genus. As far as could be ascertained in this case, the tunnel is plugged shortly after its initiation and remains so after the cell has been provisioned and closed.

Bees of the genus *Triepeolus* have been reported as parasites in nests of *Melissodes* spp. Graenicher (1905) gives a detailed account of *T. helianthi* (Robertson) on *Melissodes trinodis* Robertson. Hicks (1926) observed *T. occidentalis* Cresson entering a nest of *M. menuachus* Cresson (reported as *M. mizeae* Cresson). Hurd and Linsley (1959) record the behavior of *T. helianthi* and *Villa* sp. (Bombyliidae) at a communal nest of *M. composita* Tucker. During the entire period of our observations, no parasites were observed either at the nest sites or in excavated cells. The fact that the burrows of *M. pallidesignata* are continuously plugged offers a possible explanation for the absence of parasites.

Although *Melissodes* is recorded as arranging its cells singly, almost every account cites the presence of more than one cell per nest. During the course of our excavations at two active nest sites, no more than one cell was associated with each burrow.

A biological characteristic recorded for the Eucerinae is the very moist pollen mass at the base of the cell covered with a thin layer of nectar (Linsley, MacSwain, and Smith, 1956). Our observations with *M. pallidesignata* showed that the pollen in partially provisioned cells and those containing eggs was of a moist dough-like consistency, lacking a surface layer of nectar. However, in cells with early larval instars, the provisions had a liquid surface. It is possible that this liquefaction is due to larval secretions. Another feature of the pollen provisions of *M. pallidesignata*, which has not been reported for other eucerines, is the moderately strong fermenting odor. This odor is apparent even after the provisions have been kept in the laboratory for some time. Linsley, MacSwain, and Smith (1956) attributed this odor characteristic to the Anthophorinae, and stated that it was not evident in the Emphorinae or Eucerinae known to them.

This is apparently the first account of male *Melissodes* using burrows as sleeping sites. The habit of using dried twigs, grass stems, leaves, fresh flower heads, etc. has been observed by a number of authors. Chemsak and Thorp (1962) review most of the known information and record males of *M. robustior* sleeping on a pollen source of the females. Although a few males of *M. pallidisignata* were found "sleeping" on the floral disks of *Grindelia*, the primary nocturnal quarters were determined to be old and new female burrows, most often males being buried within the tunnel plug.

ACKNOWLEDGMENTS

This study was carried out in part during the course of investigations on pollinators of the Onagraceae (NSF No. GB-131). The assistance and helpful comments of Professors E. G. Linsley and J. W. MacSwain are much appreciated. Determination of the *Melissodes* was confirmed by Dr. W. E. LaBerge. Plant determinations were kindly provided by H. K. Sharsmith, University of California Herbarium.

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NEW JOURNAL

A new quarterly *Journal of Medical Entomology* will be published early in 1964 with Dr. J. L. Gressitt, Bishop Museum, Honolulu, Hawaii, as editor.

MEETING ANNOUNCEMENT

The annual national meeting of the Entomological Society of America will be held 30 November to 3 December 1964 at the Benjamin Franklin Hotel, Philadelphia, Pennsylvania.

BOOK REVIEW

THE TAXONOMY AND SPECIATION OF PSEUDOPHONUS. By George E. Ball and Joseph N. Anderson. The Catholic University of America Press, 620 Michigan Ave., N.E., Washington 17, D. C., 94 pages, 1962. \$3.95.

This volume is the first of a proposed series published under the auspices of the Institute for the Study of Natural Species. The book treats a very difficult taxonomic group of the order Coleoptera, family Carabidae. It is heartening to see the subgenus placed back under *Harpalus* (sensu stricto), thereby challenging the trend toward pulverization of well-known genera into many dubious genera as currently undertaken by the Jeannel school.

The grouping of the subgeneric species is based on male genitalia. The use of external fields on the inverted sac of the male armature is used almost exclusively in the classification scheme. It is unfortunate that the internal structures of the sac are not fully exploited. The value of the scheme is shown in the subgrouping in chapter III, Identification. It is supposed that the genitalic characters are sufficiently constant that such groupings can be made, for it is often found that other characters will also tend to fall in line, from which one concludes that each subgroup of *Pseudophonus* was derived from a common ancestor. In chapter V, Problems of Identification, it says that it is impossible to determine males in certain subgroups by any other means, whereas the determination of their females is essentially impossible because their genitalia have no taxonomic value. By realizing the extent of the problems involved in *Pseudophonus*, taxonomists should appreciate the difficulties encountered with all symphiles.

There is an assumption that males with different but constantly nonvariable genitalia are different species no matter how variable other morphological factors may be; such an implicit assumption may not be fully acceptable without substantially more supporting data. There is little support, if any, for the claim that there are apparent hybrids between the species *H. (P.) compar* and *H. (P.) erythropus*, despite the presence of variable male genitalia along with other mixed external characters. By referring to variations in widely ranging species as clinal, the authors dismiss subspeciation without further amplification or supporting information. The larval work by Chu is mentioned but could not be used for lack of information in depth. This all reflects rather pointedly the need for field research to complement the bench work that was performed. Concentration in further areas such as microecology, cytology, and certainly work with live specimens in the field and laboratory is necessary for the furtherance of this study. It is hoped that this will be forthcoming, for the arguments used by the authors to clarify the more difficult problems of identification of the species of *Pseudophonus* create more problems than are solved.

The part that discusses the distribution under chapter VII, Zoogeography, is highly speculative, as it must be. The pattern of distribution used by the authors is based on existing "accepted" theory, possibly even fit to it, for nothing new is added that could possibly prove or disprove it.

The very best part of this little book is the technical treatment of a mass of morphological data that alone should make it a valuable asset to all coleopterists. It is hoped that the whole series on speciation proposed by the Institute will maintain the high technical quality of this first volume.—NORMAN L. RUMPP, *China Lake, California*.

A Review of *Griselda*, with Descriptions of a Related New Genus and Two Species

(Lepidoptera : Tortricidae)

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The genus *Griselda* was proposed by Heinrich (1923) to accommodate three Nearctic species. The group was distinguished from the large, Holarctic genus *Epinotia* Hübner in having a widely bifurcate uncus. In *Epinotia* the uncus is simple or single with a bifid tip. The three American *Griselda* species are: *radicana* (Walsingham), the type of the genus, in the Pacific Northwest; *pennsylvaniana* (Kearfott), a widespread species in eastern United States; and *gerulae* Heinrich, known only from the types collected in Pennsylvania. The three comprise a loosely knit assemblage sharing little similarity in superficial appearance and wide divergence in genitalia form and habits. To these, Obraztsov (1945) added two Palearctic species, *fractifasciana* (Haworth) and *vacciniana* (Zeller). In illustrating the British species, Bradley (1959) treated the former as a synonym of *stagnana* (Schiffermüller) and the latter as synonymous with *myrtillana* (Westwood).

In *G. radicana* the bifurcate uncus consists of strongly sclerotized, spur-like points projecting posteriorly from the "shoulders" of the tegumen. In *G. gerulae* the tegumen is rounded in shape, differing markedly from *Epinotia* and *G. radicana* in this respect, and bears short, sclerotized projections at the apices of the ventral, inner margins (just posterior of the *socii*). *G. pennsylvaniana*, although similar to *gerulae* in tegumen, valva, and *socii* form, bears no projections from the posterior margin of the tegumen. Both of the latter species exhibit paired, essentially membranous lobes which project anteriorly from within the inner face of the tegumen. In addition, the large, rounded *socii* and valva form with a well-defined cucullus separate the latter two species from *radicana*. Walsingham's species has the apices of the *socii* pointed ("triangular" of Heinrich's key) and the valva narrow (both characteristics essentially as in the *hopkinsana-pulsatillana* group of *Epinotia*). Heinrich interpreted both types of tegumen projections as comparable derivations of the bifid uncus of *Epinotia*. However, in studying these species, along with two undescribed ones which are similar to *gerulae* in genitalia form, I do not agree and am unable to consider them congeneric with *radicana*.

It appears to me that the projections from the margin of the tegumen are neither constant nor comparable characters in this group. Moreover, the *gerulae* group appears to warrant generic standing based on other

genitalic features, whether or not *radicana* is to be considered apart from *Epinotia*. Besides morphological differences, *radicana* also differs in its biology; it is a conifer feeder which flies in summer and fall. In contrast, the other four species fly in early spring, in the manner of members of *Pseudexentera*. One of the four has been associated with live oak. As was pointed out by Heinrich for *gerulae*, the two new species are also unlike *Epinotia* in wing patterns and might be mistaken for *Gretchena* or *Pseudexentera* were it not for the costal fold. *G. radicana* superficially resembles *Epinotia hopkinsana*, another conifer feeder.

Thus the following arrangement is proposed to include moths of this group.

GENUS GRISELDA Heinrich

Griselda Heinrich, 1923, U. S. Natl. Mus. Bull., 123: 186; Obratzsov, 1945, Zeitschr. Wiener Entomol. Ges., 30: 33.

GRISELDA RADICANA (Walsingham)

Paedisca radicana Walsingham, 1879, Ill. Lepid. Het. Brit. Mus., 4: 53, pl. 72, fig. 5.
Griselda radicana, Heinrich, 1923, U. S. Natl. Mus. Bull., 123: 186, figs. 36, 329.

This species was described from "Rouge River, Oregon, May 1871." However, according to the Walsingham itinerary given by Essig (1941), Walsingham collected in California during May 1871 and did not arrive in Oregon until September of that year. Moreover, I know of no Rouge River in California or Oregon and none is mentioned in the Walsingham itinerary. Judging from the map given by Essig, the Walsingham party camped at or near the Rogue River in the vicinity of the present Grants Pass, Josephine County, Oregon at about the end of May or early June 1872. Thus it seems likely that the type locality should actually be the Rogue River in southwestern Oregon.

Heinrich (1923) cited specimens from Seaview in south coastal Washington and from Victoria, at the southern end of Vancouver Island, British Columbia. Material from both localities had been reared from *Picea*. The U. S. National Museum also has specimens reared from *Pseudotsuga menziesii* from Springfield, Lane County, Oregon (Hopk. No. 33477E, V. M. Carolin collector). The species is now known to range eastward to Ontario (Sippell, *et al.*, 1962) and Quebec (McLeod and Blais, 1961) and is said by Blais (1961) to be found commonly across Canada. Blais studied the biology of *G. radicana* in Quebec, where the preferred host is *Picea glauca*. Other plants used include species of *Picea* and *Abies balsamea*. The moths fly in late August and September and deposit eggs which overwinter at the base of the needles. The larvae feed during June

and July on the current year's foliage and drop to the ground for pupation.

Moths from Pacific Northwest areas generally are pale greyish, the forewings having a well-defined, outwardly angulate basal patch, outwardly edged or wholly red-brown, and a band from mid costa towards tornal area, turned down and flared just before tornus. A single specimen from central coastal California (Mill Valley, Marin Co., 2 October 1958, H. B. Leech collector) in the California Insect Survey is referred here tentatively. The forewings are dull reddish brown, with the markings dark grey, similar in form to typical *radicana*, but with the basal patch less angulate. The male genitalia are not distinguishable from Oregon and British Columbia specimens.

GRISELDA HYPsidRYAS (Meyrick), new combination

Eucosma hypsidryas Meyrick, 1925, Exot. Microlep., 3: 140; Clarke, 1958, Cat. Type Spec. Brit. Mus. Meyr., 3: 367, pl. 182, fig. 2.

On the basis of a photograph of the male genitalia given by Clarke, it appears that this species is related to *G. radicana*. In the original description Meyrick cites *hypsidryas* as having been bred from buds of *Picea morinda* in the mountains of northern India.

GRISELDA STAGNANA (Schiffermüller)

Tortrix stagnana Schiffermüller, 1776, Syst. Verz. Schmett., Wienergeg., p. 131.

Griselda stagnana, Bradley, 1959, Entomol. Gazette, 10: 72 (synonymy), pl. 10.

Tortrix fractifasciana Haworth, 1812, Lep. Brit., 3: 466 (not seen).

Rhopobota fractifasciana, Pierce and Metcalfe, 1922, Genitalia Brit. Tort., p. 75, pl. 26.

Griselda fractifasciana, Obraztsov, 1945, Zeitschr. Wiener Entomol. Ges., 30: 34.

G. stagnana is a grey, *Phaneta*-like moth known in England and central Europe (Meyrick, 1895). Ford (1949) states that the species has two generations in England, where larvae are to be found on the flowers and seeds of *Scabiosa columbaria* (Dipsaceae) in July and at the base of the plants in September. The moths fly in April and May and again in August.

GRISELDA MYRTILLANA (Westwood)

Sericoris myrtillana Westwood, 1857, Brit. Moths, 2: 146, pl. 89, fig. 15.

Griselda myrtillana, Bradley, 1959, Entomol. Gazette, 10: 72 (synonymy), pl. 11.

Grapholitha vacciniana Zeller, 1846, Isis von Oken, p. 248.

Rhopobota vacciniana, Pierce and Metcalfe, 1922, Genitalia Brit. Tort., p. 75, pl. 26.

Griselda vacciniana, Obraztsov, 1945, Zeitschr. Wiener Entomol. Ges., 30: 34.

This greyish moth with dark basal patch, median and subapical trans-

verse bands, ranges through north and central Europe and the British Isles. In England the larvae feed on *Vaccinium myrtillus* (Vacciniaceae) during July and August, the adults flying in May and June (Meyrick, 1895).

Judging from the figures given by Pierce and Metcalfe (1922) and Bradley (1959), both this and the preceding species may provisionally remain in *Griselda*. Their biologies differ from *G. radicana*, and further studies might indicate that the latter should not be considered congeneric with *stagnana* and *myrtillana*. However, the European species seem wholly unrelated to members of the following genus.

Chimoptesis Powell, new genus

Head.—Labial palpus moderately elongate, broadly expanded by spreading scales, not much upturned; antenna slightly longer than one-half forewing length, scaled dorsally and ventrally, anterior margin densely short ciliate in male; tongue unscaled; scaling of front appressed, of crown dense, bushy. *Forewing*.—Smooth scaled; elongate-narrow, little broadened towards termen; costal fold present in male, tightly appressed, enclosing a fine brush of elongate hairs and an imbricate series of modified, broad scales; costa slightly curved beyond, costa of female slightly, uniformly curved from base to apex; apex rather acute; termen concave above tornus; dorsum very slightly curved. Twelve veins, all separate: Sc, enclosed by costal fold in male, nearly straight; R_1 from slightly before middle of discal cell, R_2 from three-fifths, nearer to R_3 than to R_1 ; R_4 , R_5 , and M_1 approximate at base, diverging; internal vein M in cell well developed, from slightly before midpoint between R_1 and R_2 ; M_2 and Cu_1 rather strongly curved, almost parallel; Cu_2 from about three-fifths of discal cell, slightly upcurved at tornus; A_1 scarcely evident at margin; furcate basal stem $A_2 + A_3$ about one-third the length of the whole vein. *Hindwing*.—About one-third broader than forewing; costa convex towards middle; apex acute; termen straight or slightly convex; dorsum very slightly convex before anal curve. Hair tufts of cubital and anal veins rather sparse, erect, spreading. Sc adjoining R for a distance at base; distal branch of R and M_1 closely parallel on basal third, then sharply divergent, enclosing apex; M_2 well separated from $M_3 + Cu_1$ at base, only very slightly curved; basal stem of $M_3 + Cu_1$ about three-fifths their length; Cu_2 from beyond three-fifths of discal cell, almost straight; all three A veins distinct to margin, A_2 curved before margin. *Male genitalia*.—Uncus lacking, posterior margin of tegumen entire or with sclerotized projections at posterior bases of socii; tegumen broadly rounded, inner face of tegumen bearing two elongate projections, directed anteriorly; socii large, well developed, broad from base; gnathos reduced, very weakly sclerotized. Valvae simple, cucullus well defined, densely hairy anteriorly, with dense, short, strong spines posteriorly; neck rather strongly constricted, without well-developed spines or hair clusters; clasper lacking. Aedeagus simple, straight, stout. *Female genitalia*.—Papillae anales simple, rotated 90° outward, densely clothed with elongate setae exteriorly; sclerotized portion of segments IX + X produced into a lobe dorsad or simple; posterior apophyses short, stout; segment VIII narrowly sclerotized on dorsal half with a pair of small projections of the sclerotized band cephalad. Sterigma fused with sternite VII, sclerotized, extending laterally into arms angling cephalad; ductus bursae narrow, simple, looped, or with

a twist just before corpus bursae; signa narrow, round, thorn-like; surface of corpus bursae densely covered with unpigmented spiculae.

TYPE OF THE GENUS.—*Chimoptesis chrysopyla* Powell, new species.

As discussed above the genus is related to *Epinotia* (Eucosmini), differing particularly in the form of the uncus and socii. According to characteristics of the wing venation and male genitalia, *Chimoptesis* is also related to the *Eucosma-Phaneta* (= *Thiodia*, Heinrich not Hübner) group and will run to *Eucosma* in Heinrich's (1923) key. The wing venation is quite similar to *Eucosma* and *Pseudexentera*; and in wing shape and general superficial appearance, the present genus rather resembles the latter as well as *Zeiraphera*. However, the well-defined costal fold distinguishes *Chimoptesis* from *Zeiraphera*, *Gretchena*, *Pseudexentera*, and *Phaneta* (as defined by Heinrich). From all these and *Eucosma* as well, it differs strikingly in structure of the male genitalia. The unique tegumen with its inner projections, together with the enlarged socii, are unlike any other Olethreutinae I have examined.

***Chimoptesis chrysopyla* Powell, new species**

A moderate-sized, *Pseudexentera*-like moth, having the narrow forewings somewhat variably marked, but showing a fairly well-defined basal patch on a pale greyish olivaceous mottled ground.

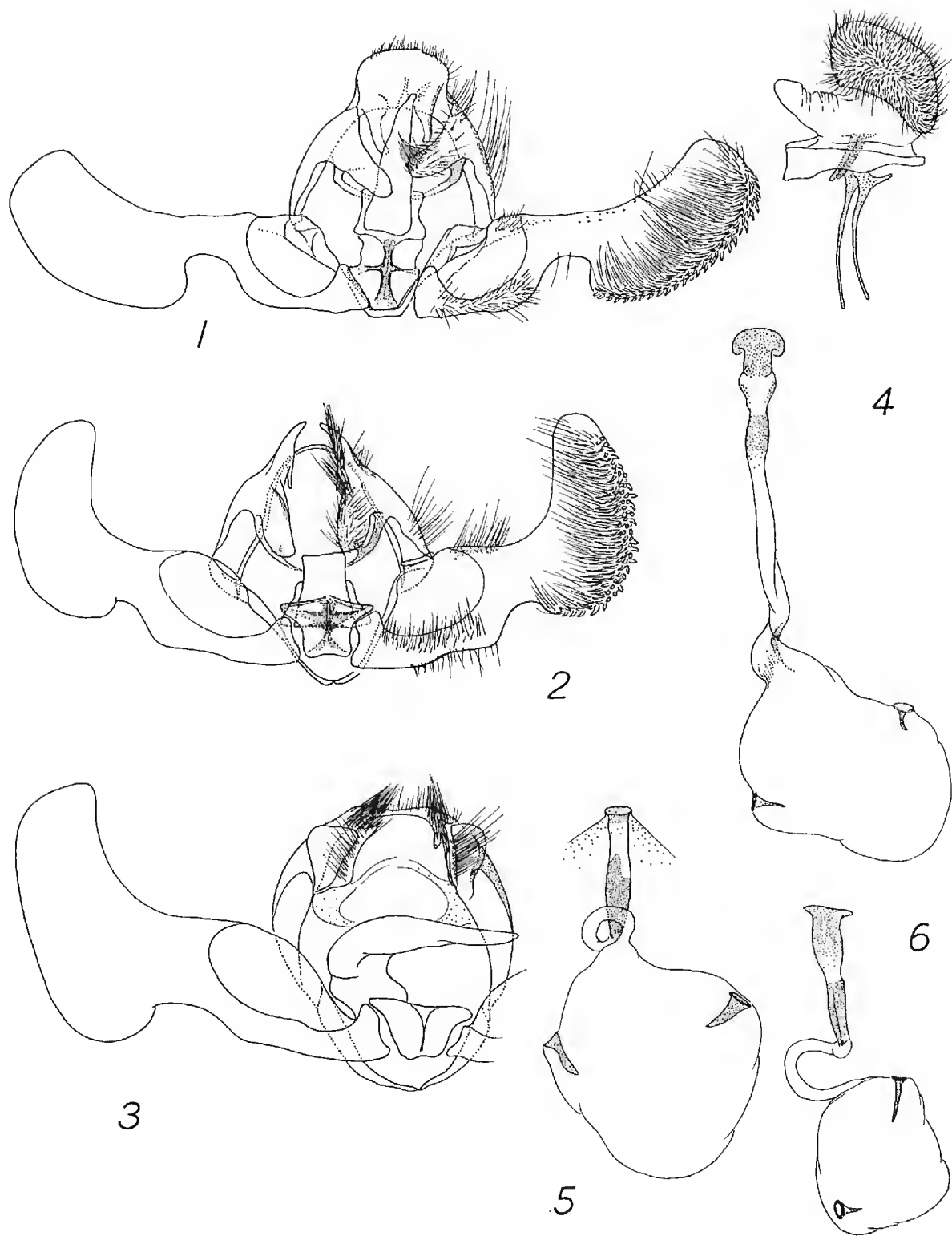
HOLOTYPE MALE.—Length of forewing 8.3 mm. *Head*.—Labial palpus moderately large, length of second segment about 1.1 times eye diameter, greatly expanded dorsally and ventrally into a broad, roundish tuft which about one-half obscures the appressed-scaled third segment; latter about one-half the length of second; scaling mixed whitish and grey exteriorly, the grey forming a dark shade diagonally across the broad tuft; whitish interiorly. Scaling of antenna complete, dorsally grey with whitish tips, ventrally white. Scale tufts of crown elongate, spreading, scales grey with bifid, white tips; of front white, appressed. *Thorax*.—Hoary grey above, the greyish scales broadly whitish towards apices. Underside shining white; legs grey exteriorly, banded with white, pro- and mesothoracic darker. *Forewing*.—Length about 3.2 times width, appearing quite broadened distally due to the costal fold and a broad fringe, especially towards tornus; costal fold over one-third forewing length, tightly appressed, enclosing a brush of about 30 elongate, white hairs and an imbricate series of about 30 broad, rounded, dark scales along the wing surface below Sc. Ground color white with occasional greyish scales interspersed, giving a slightly superficial olivaceous tinge, and with more or less defined dark grey markings: basal one-third of wing, enclosing a paler area at dorsum and becoming less distinct towards costa, costal fold banded pale and dark grey; outer margin of basal area narrowly black, concave above dorsum, with a few pale brown scales outwardly; a series of grey spots along costa beyond fold and around apex and termen before fringe; grey mottling beyond cell becoming more restricted and forming blackish spots on a whitish ground in dorsal half, the spots forming an ill-defined line at outer two-thirds from about end of cell, curved outwardly and recurved to dorsum,

defining an irregular, pale dorsal blotch between it and the basal patch; this blotch, the palest area of the wing, encloses a dark, vertical line from dorsum. Fringe dark grey, becoming paler towards tornus, a dark grey spot at its termination below tornus. Underside rather dark grey, the whitish interspaces of outer half of costa reproduced. Fringe pale basally. *Hindwing*.—Dark grey dorsally, the broad fringe whitish with a dark basal band. Underside similar, slightly paler. *Abdomen*.—Pale greyish dorsally; underside and genital tuft white. Genitalia as in Fig. 1 (drawn from paratype, Berkeley, JAP prep. No. 565, four preparations examined); posterior margin of tegumen entire; aedeagus with a small, subapical prong.

Allotype female.—Length of forewing 8.6 mm. Essentially similar to male but having the forewing markings darker and more distinct. Costal area in basal third rather whitish (paler than fold in male); basal patch blackish, margined outwardly by a dark black, straight, vertical line; pale area near base on dorsum indistinct, margined inwardly by a discernible black line; pale area beyond cell more extensive towards costa than in male, the spotting considerably more contrasting. Genitalia as in Fig. 4 (drawn from topoparatype, JAP prep. No. 1268, three preparations examined); dorsum of segments IX–X produced into a bulbous lobe; ductus bursae with a wide sclerotized ring just below sterigma and a small sclerotized spot dorsally.

Holotype male and allotype female, GOLDEN GATE PARK, SAN FRANCISCO, CALIFORNIA, 26 February 1960 (J. Powell), deposited in the California Academy of Sciences. Paratypes (254), all California, as follows. Marin Co.: Mill Valley, 5 ♀, 4–9 February 1926 (E. P. Van Duzee). Contra Costa Co.: Walnut Creek, 1 ♂, 7 February 1962, at light, 53–54° F (J. Powell). Alameda Co.: Berkeley, 1 ♂, 1 March 1959, at light, 1 ♂, 10 February 1960, at light (J. Powell); Strawberry Canyon, Berkeley Hills, 1 ♂, 17 January 1962, on bark *Quercus agrifolia* (J. Powell). San Francisco Co.: San Francisco, 1 ♂, 24 February 1926 (H. H. Keifer); Golden Gate Park, 2 ♂, 17 February 1960, “flying nr. *Quercus agrifolia*” (P. H. Arnaud, Jr.), 93 ♂, 24 ♀, 18–26 February 1960, on bark *Q. agrifolia* (P. H. Arnaud, Jr., C. D. MacNeill, and J. Powell), 7 ♂, 4 ♀, 3 March 1960, “coll. on trunk *Quercus agrifolia*” (1 pair *in copulo*) (P. H. Arnaud, Jr.), 1 ♂, 1 ♀, 10 March 1960 (C. D. MacNeill), 1 ♂, 1 ♀, 18 March 1960 (P. H. Arnaud, Jr., and J. Powell), 8 ♂, 6 ♀, 6–14 February 1961 (P. H. Arnaud, Jr., P. P. Cook, C. D. MacNeill, and D. C. Rentz), 8 ♂, 9 ♀, 28 February 1961 (P. P. Cook and C. D. MacNeill), 1 ♂, 2 March 1961 (P. H. Arnaud, Jr.), 1 ♂, 10 February 1962 (B. R. MacLennan). Deposited in the American Museum of Natural History, British Museum, California Academy of Sciences, California Insect Survey, and U. S. National Museum.

Taxonomic discussion.—Length of forewing range in paratypes, males 7.2–8.5 mm, females 7.3–8.6 mm. Although the wing pattern is variable in terms of development and intensity of the grey mottling, the moths have essentially the same superficial appearance. The sexual dimorphism in wing color is quite constant, and the less variable females are distin-



EXPLANATION OF FIGURES

Figs. 1-3. Male genitalia of *Chimoptesis*, ventral aspect. 1, *C. chrysopyla* Powell; 2, *C. matheri* Powell; 3, *C. pennsylvaniana* (Kearfott). Figs. 4-6. Female genitalia of *Chimoptesis*. 4, *C. chrysopyla*, structures of segments VIII-X, lateral aspect, internal structures, dorsal aspect; 5, *C. matheri*, internal structures, dorsal aspect; 6, *C. pennsylvaniana*, internal structures, dorsal aspect.

guishable from the males on color pattern in nearly every case. The dark basal patch, especially its straight, black outer margin, is always more contrasting in the females. In addition, males often have considerable development of pale brown scales marginal to the outer edge of the basal patch. This tends to diminish the distinctness of the contrast between the dark basal area and the dorsal blotch beyond. At times the brown is broadened so as to be visible to the naked eye, and is accompanied by scattered brownish scales beyond the ill-defined curved line outwardly marginal to the pale dorsal blotch. Occasionally males have the pattern reduced by a general fading of the dark grey and an infusion of pale greyish in the white areas, so that the markings are inconspicuous, although visible.

Biology.—The moths are found in association with coast live oak, *Quercus agrifolia*, in early spring before the new season's growth begins. At the type locality *C. chrysopyla* exists in a restricted colony, associated with a small grove of eight or ten trees, yet as many as 50 adults have been taken there in an hour's time. During midday both sexes rest on the bark of the trunk and large branches, mostly about 3 to 5 feet above the ground, apparently without correlated orientation as to shade and light. Most individuals were observed in crevices, depressions, etc., where they experience a very cryptic concealment on lichen- and alga-covered surfaces. They appear to have an increased activity on warmer days, but occasional records of light attraction suggest that the species is normally nocturnal or crepuscular. When disturbed, the moths often do not fly but "jump" outwards and fall, feigning death. On the ground they are extremely difficult to locate among the leaf litter due to this habit.

Repeated sampling of the leaf-feeding caterpillar community of *Q. agrifolia* in the Bay area has not produced *C. chrysopyla*. This fact, together with the reaction of the abdominal contents of the adults in caustic solution, leads me to suspect that the species is a borer, perhaps in the crown region of *Q. agrifolia*. Painstaking search for the pupation site during February 1960 and January 1962 and 1963 has resulted in only indirect evidence. Examination of the bark where the moths congregate revealed cocoons of other species (Powell, 1963), but no trace of *Chimoptesis* was found. However, among the numerous pupae and pupal shells in the leaf litter and soil under the oaks was a tortricid pupal shell, which may be that of *C. chrysopyla*. Several were found on the surface of the sandy soil around the bases of the trees, and one was discovered protruding from a hard, dirt-covered case affixed to the bark just at the soil level. These pupal shells are similar to those of the related moth, *Pseudexentera habrosana* (Heinrich), but differ in the armature of the final abdominal seg-

ments, particularly the cremaster, which consists of a circle of heavy triangular spurs, rather than the pair of lateral spurs of *P. habrosana* (Powell, 1961). The latter species, an oak foliage feeder, has been taken in small numbers at the site flying with *C. chrysopyla*.

CHIMOPTESIS GERULAE (Heinrich), new combination

Griselda gerulae Heinrich, 1923, U. S. Natl. Mus. Bull., 123: 187, fig. 324.

This species was described from New Brighton, Beaver County, Pennsylvania, from a male and female collected 26 March 1902 by H. D. Merrick. The moth has remained poorly known and at present nothing can be added to the biology, distribution, or description beyond that given by Heinrich.

The forewing is described as "pale dull ochreous fuscous" with a "white patch on the middle of dorsal margin followed and preceded by a faint shading of blackish fuscous," and with a somewhat irregular, curved line of black from mid costa to upper angle of cell. A photograph of the male genitalia was given by Heinrich (1923, fig. 324). In these structures the present species resembles *C. chrysopyla* but differs markedly by the possession of short, horn-like projections from the tegumen at the posterior bases of the socii. *C. gerulae* is similar to the following species both in external appearance and in male genitalia, differing mainly by the smaller, narrower valvae.

Chimoptesis matheri Powell, new species

A moderately small, dull brownish-grey moth, the forewings usually showing a dark basal area and subterminal longitudinal streak; occasionally with a whitish dorsal patch.

Holotype male.—Length of forewing 6.9 mm. *Head*.—Length of second segment of labial palpus about equal to vertical eye diameter, greatly expanded distally by spreading scales into a broad, rounded tuft; brownish exteriorly with some intermixed white scales, forming a more or less defined spot near apex, whitish interiorly; third segment about two-fifths the length of second, protruding well beyond scaling of second, appressed-scaled, brownish. Scaling of antenna brown, of head pale brownish, the bifid scale tips white. *Thorax*.—Scaling brown dorsally, shining white ventrally; scaling of pro- and mesothoracic legs brown exteriorly with pale tarsal and tibial bands, whitish interiorly, metathoracic leg (one lacking from holotype) whitish. *Forewing*.—Length about 3.1 times width at end of cell; costa very slightly bent beyond fold, termen strongly angled back, slightly concave; costal fold slightly greater than one-third costa length, enclosed brush white, becoming grey in distal half, of about 36 stiff hairs, appressed, broad scales black near base of fold, white in central area, dark grey in distal half, subcostal (upper) area inside fold with a dense covering of modified, black sex scaling (as in *Proteoteras*) along

distal half. Wing scaling ground color brownish, heavily infused with pale ochreous tinged with reddish, except adjoining dark markings; a blackish streak along lower fold from base to middle of wing, a second, short streak through end of cell, separated beyond by ground color from a third streak just before apex; two leaden-colored bars in terminal area extending downward below subapical streak, irregularly replaced by ground color; a series of whitish dashes on outer third of costa. Fringe dark brownish at apex, becoming shining pale grey towards and around tornus. Underside pale grey-brown, whitish along dorsum, the pale costal dashes reproduced. *Hindwing*.—Apex acute, termen straight. Dark grey, slightly paler towards base; fringe pale, shining grey with a darker basal band. Underside dirty whitish, clouded with grey scales along costal area and distal portions of veins. *Abdomen*.—Scaling dark brownish grey including genital tuft; scaling of valvae white. Genitalia as in Fig. 2 (drawn from paratopotype, JAP prep. No. 1258, five preparations examined); margin of tegumen with sclerotized projections at posterior bases of socii; gnathos arms weakly sclerotized at bases, becoming membranous at their junction; aedeagus truncate, vesica at times with a bundle of a dozen or more long, thin cornuti.

ALLOTYPE FEMALE.—Length of forewing 6.9 mm. Essentially as described for male, lacking antennal setation and costal fold; forewing broader in basal third. Ground color brownish, generally darker than in male, with less ochreous scaling; dark basal streak of fold contiguous with a basal patch over inner one-third of dorsum, margined outwardly by a distinct, vertical line; dark streaks of distal part of wing also broadened but not well defined; area between leaden bars a more well-defined "ocellus" of ochreous marked by two or three horizontal black hairlines. Genitalia as in Fig. 5 (drawn from paratopotype, JAP prep. No. 1486, three preparations examined); dorsum of abdominal segments IX–X without lobe-like development; sterigma a simple, straight margined plate, ductus bursae looped, with an elongate, subbasal sclerotized region.

Holotype male and allotype female, CLINTON, HINDS COUNTY, MISSISSIPPI, 27 January 1960 and 10 February 1959, respectively (Bryant Mather; nos. 3750, 573), deposited in the California Academy of Sciences. Seventeen paratypes as follows: Clinton, Hinds Co., Miss., 5 ♂, 3 ♀, 7–13 February 1959, 2 ♂, 27 January 1960, 1 ♂, 4 February 1960, 2 ♂, 1 February 1963 (Bryant Mather); Pensacola, Escambia Co., Florida, 2 ♂, 24 and 26 January 1962, 2 ♀, 5 and 22 February 1962 (Shirley Hills), deposited in collections of American Museum of Natural History, California Insect Survey, Shirley Hills, Bryant Mather, and U. S. National Museum.

Taxonomic discussion.—Range of length of forewing in paratypes, ♂ ♂ 5.9–7.1 mm, ♀ ♀ 6.7–7.5 mm. Most of the males are similar to the above description in forewing color pattern, but occasional examples show the dark basal patch described for the allotype. One male from Clinton has the pattern obliterated by infuscation over the whole forewing; only a streak or two of ochreous scales remain. A dark male from Pensacola has the dash marks of the costa continued downward into the

ground color as bluish leaden streaks; similar but ill-defined vertical streaks appear in the dorsal area. Both females from Pensacola and one from Clinton have a white dorsal patch immediately following the abruptly delimited dark basal patch. The white patch, which is not present on paratype males, is less well developed on one of the Pensacola specimens where it is accompanied by two well-defined ochreous costal blotches.

One additional male from Sarasota County, Florida (Siesta Key, 27 January 1954, C. P. Kimball) has been studied and not designated as a paratype. It is smaller (forewing length 5.4 mm) and has the forewing a rusty brown, showing the basal patch. The genitalia do not differ appreciably from *matheri*, however, so that it is referred here provisionally.

The species is closest anatomically to *gerulae* among known *Chimoptesis*; *matheri* differs by its broader valvae which are larger in relation to the tegumen, and by the forewing color pattern. In *gerulae* the white dorsal blotch is present on both sexes in the small series known.

Nothing is known of the biology of *C. matheri*. All the specimens were probably taken at lights.

CHIMOPTESIS PENNSYLVANIANA (Kearfott), new combination

Proteopteryx albicapitana pennsylvaniana Kearfott, 1907, Trans. Amer. Entomol. Soc., 33: 48.

Griselda pennsylvaniana, Heinrich, 1923, U. S. Natl. Mus. Bull., 123: 187.

This species was also described from New Brighton, Beaver County, Pennsylvania, the type having been collected in March. As the original citation indicates, it is similar in appearance to *Epinotia albicapitana* (Kearfott), which was described at the same time from California. Both species exhibit a sinuate margined pale dorsal area. Heinrich (1923) reported *C. pennsylvaniana* also from Massachusetts, Missouri, and Texas. Specimens I have examined from Mississippi (Clinton, Hinds Co., 10 February 1959, 10 and 22 March 1960; B. Mather) have a decided greenish tinge in the pale areas of the forewing which has not been mentioned for populations in other areas.

Since Kearfott devoted most of his discussion to *albicapitana* and no description has been given for *pennsylvaniana* subsequently, the species may be characterized as follows (based on specimens from Mississippi):

Male.—Length of forewing 7.6–8.0 mm. *Head*.—Labial palpus with length of second segment slightly greater than vertical eye diameter, greatly expanded by spreading scales into an apical, rounded tuft, dark brown exteriorly with some whitish scales along dorsal margin, whitish interiorly; third segment slightly greater than one-third the length of second, mostly exposed, appressed-scaled, dark brown.

Antennal scaling reduced, dark brown; setae small. Head scaling spreading, except appressed on front; front and crown white, lateral margins and tuft above front dark brown. *Thorax*.—Dorsal scaling mixed whitish and dark brown, either may be dominant, tegulae at times whitish tinged with greenish. Underside shining white; pro- and mesothoracic legs dark brown exteriorly except for distinct white tibial and tarsal bands. *Forewing*.—Costal fold on basal one-third, costa nearly straight beyond; enclosed brush and appressed scaling of costal fold as in *C. matheri*, including the black sex scaling of subcostal (inner) area. Ground color blackish, dorsum with a broad white band from base to tornus, irregularly blotched with pale green, separated from ground color by a distinct, sinuate line, curving into dorsal area at one-fourth, into dark ground just before middle of wing; dorsal area broken by a recurved extension of ground color just before tornus, continued beyond, reaching nearly to mid-termen. Ground color mottled, irregularly blotched with paler areas and with about six pale costal dashes in basal half; costa with a small V-shaped white mark before apex. Fringe concolorous, becoming shining pale grey towards tornus. Underside dull grey, the pale costal marks reproduced; whitish in dorsal area. *Hindwing*.—Pale shining grey above; whitish below, becoming greyish towards outer margin. *Abdomen*.—Shining pale greyish, anal tuft paler, scaling of valvae whitish. Genitalia as in Fig. 3 (drawn from plesiotype, Clinton, Miss., JAP prep. No. 1491, two preparations examined); tegumen without posterior projections except rudimentary bumps at posterior bases of socii, latter rather rectangular, with conspicuous, posteriorly directed brushes of stiff setae; cucullus well developed, elongate.

Female.—Length of forewing 7.9 mm. Essentially as described for male, forewing without costal fold, appearing broader. Ground color slightly less mottled, darker, especially towards dorsal area, the marking more contrasting. Genitalia similar to *C. matheri*, differing by the more rounded sterigma and greater development of sclerotization on the ductus bursae, as in Fig. 6 (drawn from plesiotype, Clinton, Miss., JAP prep. No. 1487, one preparation examined).

ACKNOWLEDGMENTS

Thanks are due to Mrs. Shirley Hills, Pensacola, Florida, Charles P. Kimball, West Barnstable, Massachusetts, and Bryant Mather, Jackson, Mississippi, who have provided me with considerable interesting Microlepidoptera from the Gulf states. Acknowledgment is also made to the following whose cooperation permitted use of collections in their care: J. F. Gates Clarke and D. R. Davis, U. S. National Museum; and C. D. MacNeill, California Academy of Sciences; and to the latter for assistance with biological investigations of *C. chrysopyla*.

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ZOOLOGICAL NOMENCLATURE: Notice of proposed use of plenary powers in certain cases (A. [n.s.] 62)

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full details of which will be found in *Bulletin of Zoological Nomenclature*, Vol. 21, Part 1, published on 25 March 1964.

(6) Designation of a type-species for *Hypercompe* Hübner, (1819) (Insecta, Lepidoptera). Z.N. (S.) 1611.

Any zoologist who wishes to comment on the above case should do so in writing, and in duplicate, as soon as possible, and in any case before 25 September 1964. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 25 September 1964, be brought to the attention of the Commission at the time of the commencement of voting.

All communications on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S. W. 7, England.—W. E. CHINA, *Acting Secretary to the International Commission on Zoological Nomenclature*.

***Catharosia lustrans*, A Tachinid Parasite of Some
Drymine Lygaeidae**

(Diptera and Hemiptera-Heteroptera)

PETER D. ASHLOCK AND CHARLES W. O'BRIEN

University of California, Berkeley

Catharosia lustrans (Reinhard) is a rare and attractive little tachinid previously known from few specimens. Approximately 35 individuals were recently collected as parasites on two equally rare lygaeids, *Thylochromus nitidulus* Barber and *Eremocoris opacus* Van Duzee (both subfamily Rhyparochrominae, tribe Drymini). The lygaeids were first discovered in February and were collected through May on a site a mile southeast of Inverness, Marin County, California, in chaparral, where they were feeding on the dry, fallen seeds under manzanita. The two species have been collected together under the same bush.

Because of the rarity of the lygaeids (Sweet and Slater were forced to omit *Thylochromus* from their nymphal key to genera of Lygaeidae, 1961, for lack of material), it seemed a good idea to try to obtain nymphs. Consequently, colonies were established in the laboratory using the method described by Sweet (1960), but with manzanita seeds for food. Nymphs were obtained, and will be described in another paper; more interesting was the parasite that emerged from both species of lygaeid.

Shortly after the first *Thylochromus* colony was set up, a puparium was observed in the petri dish; a few days later a fly was seen moving about in the manner characteristic of members of the family Pompilidae, flicking its wings as it walked. A dead lygaeid female with a protruding ovipositor was found at the same time. The fly was identified by Drs. Frank R. Cole, Paul H. Arnaud, Jr., and Curtis W. Sabrosky as *Catharosia lustrans* (Reinhard). Most members of the subfamily Phasiinae, to which it belongs, are parasites on Hemiptera, but nothing was known about the biology of the phasiine tribe Catharosiini.

Encouraged by these dipterists, we set up more colonies, especially of *Thylochromus*, and were able to make a number of interesting observations of the rate of the parasite's development in host and puparium, and the effect it had on its host.

The parasitized bug, most often a female, shows little sign of its parasite until two or three days before the larva emerges. At this time, the bug appears on superficial examination to be gravid, so

gravid that the ovipositor cannot be folded into its normal position. Closer examination shows that the head is exerted so that the membrane between head and prothorax is clearly visible. Dissection of one parasitized female revealed that while the ovaries were completely consumed, the gut was intact. One parasitized female did live for a full month after emergence of the parasite, and in the course of the month laid a total of five eggs. The larva from this female died before the puparium was fully formed. However, few hosts lived for more than two or three days; they could easily be recognized by their translucent abdomens and the extruded genitalia or the scar on the edge of the connexivum.

The mature larva is white and its only ornamentation is tiny mandibular hooks and a long posterior spiracular process. The larva on emerging crawls a short distance from the host, becomes quiescent, assumes an oval shape, and slowly begins to darken in color. After about 11 days when the host is *Thylochromus* (19 examples) and 13 days when the host is *Eremocoris opacus* (six examples), the fly emerges from the puparium.

The time of development from puparium to adult fly was determined by dating the emergence of the puparium, isolating it with the host in a vial, and dating the emergence of the adult fly. The time of development from egg to puparium, in the host, was more difficult to determine. The field-collected parasitized lygaeids indicated at best only a minimum limit of the developmental period; i.e., the longest period between collection and discovery of puparium, which was eight days for *Thylochromus* and 24 days for *Eremocoris opacus*. Somewhat more exact information was obtained in a laboratory experiment involving an undescribed species of *Eremocoris* which is not, to our knowledge, naturally parasitized by the tachinid. The new *Eremocoris* that was experimentally exposed to the fly was from a colony several generations old and was completely free of these parasites. Because of the short life of the tachinid parasite under these conditions, it took some time to obtain a mating pair; that accomplished, the male and female, isolated in a vial, mated several times. The impregnated female was then removed from the vial and added to a dish containing a small colony of the *Eremocoris*. The usual sunflower seeds and water were included for the *Eremocoris*, and a cotton-stoppered vial of sugar water for the fly.

The actual deposition of eggs on the host bug was not observed, but several times the female fly was seen to "march" rapidly along about a half an inch behind an *Eremocoris*, which appeared to be run-

ning to escape it. Each observed chase was broken off without incident. The fly lived for two days in the colony. Twelve days later a puparium was observed, from which, after 13 days, an adult fly emerged.

As might be expected, the size of the parasite reflected the size of the host lygaeid: the *Thylochromus*, being the smallest, yielded the smallest *Catharosia*, while the new species of *Eremocoris*, being the largest host, yielded the largest fly.

The relevant tachinid material has been turned over to Dr. Paul H. Arnaud, Jr., for taxonomic study.

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SCIENTIFIC NOTE

Mating behavior of *Incisalia iroides* (Boisduval) (Lepidoptera: Lycaenidae).—A small lemon tree at my home in Walnut Creek (foot of Shell Ridge), Contra Costa County, California, was frequently used as a perch by individuals of *I. iroides* during the spring of 1963. Two individuals were noted there as early as 3 March at 9:30 a.m., with the air temperature at 49° F. One or more were observed on many occasions during the following two months. It has been my experience that hairstreak butterflies are not seen as often in copulation as are other butterflies. Thus, when a pair of *I. iroides* was observed in mating position on 24 May at about 5:30 p.m. (P.D.T.) (63° F, 62% R.H.), it was of interest because a similar observation had been made earlier in the month. Two days later there were two pairs of this species copulating on the lemon tree at 5:20 p.m. (60° F, 66% R.H.). They were examined about every half hour until nearly sunset at 7:45 p.m. (52° F, 86% R.H.). During this time the pairs moved occasionally from leaf to leaf, but did not fly. Again on 30 May a mating pair was on the tree at 5:15 p.m. (71° F, 54% R.H.). During that day a fresh-appearing male had been noted on several occasions flying about the spot and defending the site, but both mating individuals were in a worn condition. Although *I. iroides* individuals often perched on the tree during midday hours, none were seen mating earlier than 5:00 p.m. (4:00 p.m., P.S.T.). Thus the secretive mating behavior in this instance, and possibly by the species in general, is due to its occurrence at a time of day when field observations are not normally made.—JERRY A. POWELL, *University of California, Berkeley*.

Rediscovery and Redescription of the Moth, *Euxoa marinensis*

(Lepidoptera : Noctuidae)

JOHN S. BUCKETT

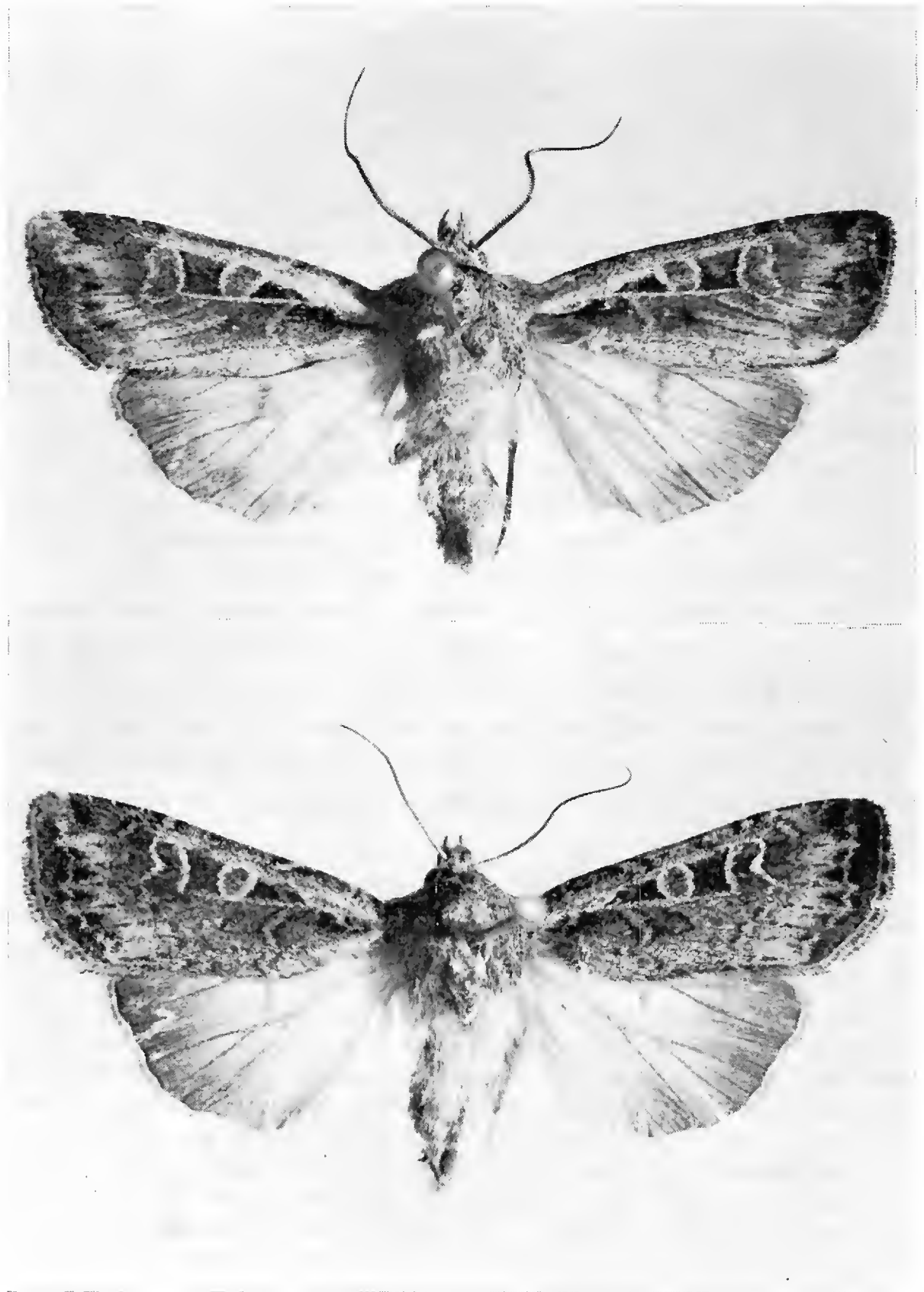
University of California, Davis

Euxoa marinensis McDunnough in the past has been known only from the type series and two specimens in the Bauer-Buckett collection, Davis. The holotype male (Number 5204 in the Canadian National Collection) was collected by W. R. Bauer at Inverness, Marin County, on 12 June 1940. During 1962, two additional collections of *E. marinensis* were made. It was commonly taken at a 15-watt fluorescent black light near Walker Creek, 2 miles south of Tomales, Marin County, California, in late July through August 1962 (J. S. Buckett and G. M. Trenam). Another series was collected at Dillon Beach, Marin County, 25 June through 12 August 1962 (M. G. Tunzi). Both localities were characterized by bush lupine, *Lupinus arboreus* Sims, and various grass species.

Neither the undissected adult nor the male and female genitalia have been previously illustrated, nor has the adult female been described. Apparently nothing is yet known of the immature stages of this insect.

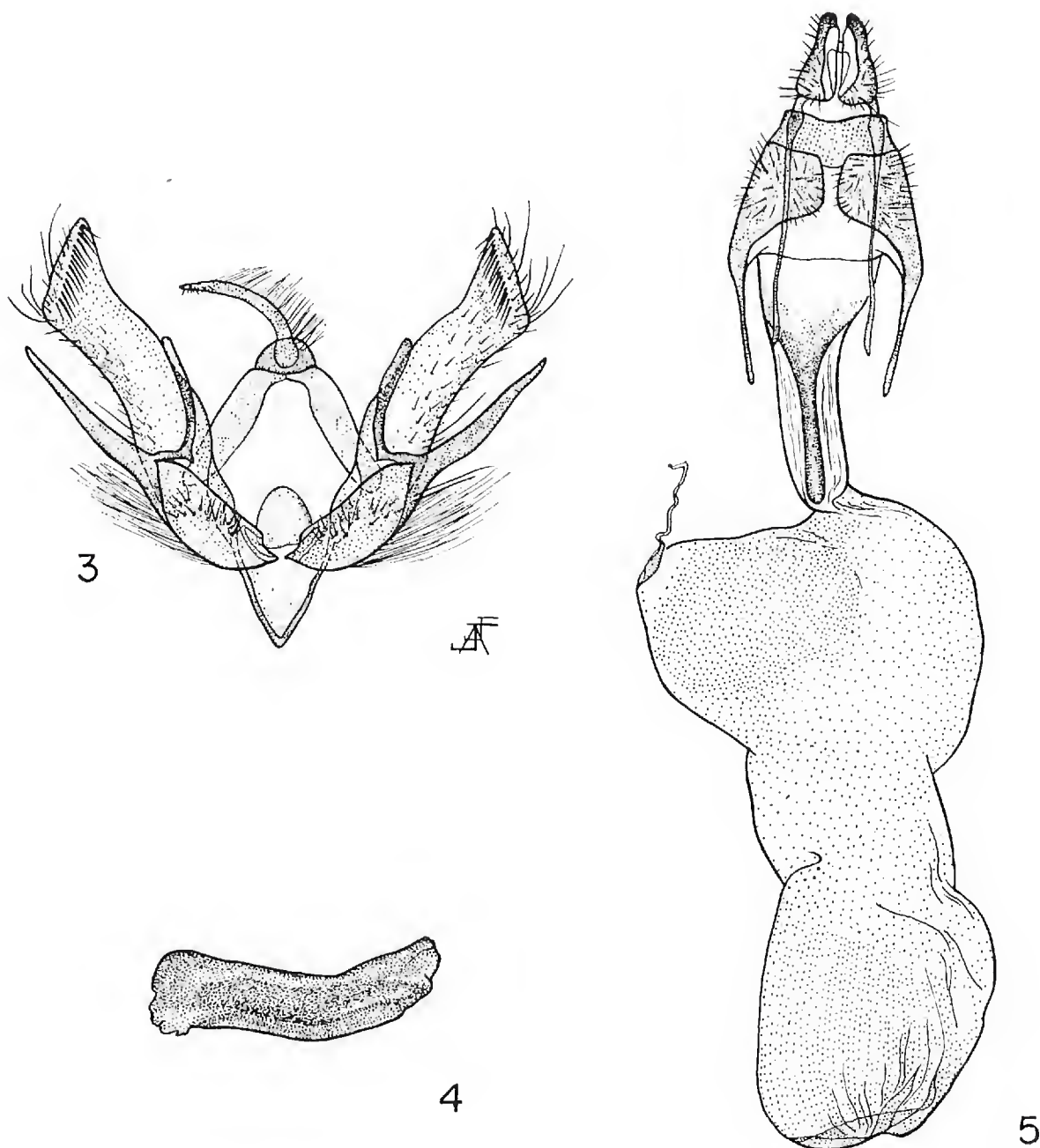
Euxoa marinensis is distinct from any other species in the *costata* group in anatomical features as well as in habitat. For the original description see McDunnough (1941). Supplemental descriptions are given as follows:

MALE.—Head and abdomen nearly concolorous, brown. Palps clothed with black hairs and brown scales, terminal segment slightly less than one-half length of preceding segment; proboscis black; a tuft of brownish tinged, red hairs protruding over frontal prominence; antennae bipectinate basally, tapering to simple ciliate terminally. Collar black; dorsum of thorax with intermixed brown, and fawn-colored hairs and scales, tipped with white; anterior tuft with white-tipped hairs; laterally at wing bases, pubescence shades into fawn-brown, or red-brown. Primaries with broad silver costal band, basally to just past reniform; thin silver band on cubital vein from basal area to below silver outlined orbicular, thence to base of silver outlined reniform, latter centrally with yellowish or cream-colored scales on outer portion, opening into costal band; ordinary lines obscured with exception of transverse anterior line which bows outwardly at middle, thence inwardly toward inner margin; inner margin with broad silver band from basal area to hind angle; subterminal line basally washed with white, apically dark brown; terminal space deep brown; terminal line indicated by small, black lunules between veins; fringes light brown. Ventral surface deep brown, reniform indicated by deeper brown. Secondaries very light smoky with broad brownish band at outer margin; discal lunule prominent, unicolorous with band; fringes white. Ventral surface dirty white, irrorated with brown scales near costal margin; discal lunule prominent, dark brown. Legs not banded, clothed with white-tipped brown hairs. Abdomen dark brown dorsally; ventrally dark brown intermixed with whitish and reddish scales and hairs.



EXPLANATION OF FIGURES

Figs. 1-2. *Euxoa marinensis* McDunnough. 1 (upper photograph), Male, 2 miles south of Tomales, Marin County, California, 22 July 1962 (J. S. Buckett and G. M. Trenam). 2 (lower photograph), Female, Dillon Beach, Marin County, California, 5 July 1962 (M. G. Tunzi).



EXPLANATION OF FIGURES

Figs. 3-5. *Euxoa marinensis* McDunnough. 3, Male genitalia minus the aedeagus, 2 miles south of Tomales, Marin County, California, 21 July 1962 (J. S. Buckett and G. M. Trenam), Bauer-Buckett Slide 62B4-25. 4, Aedeagus; same data as in Fig. 3. 5, Female genitalia, 2 miles south of Tomales, Marin County, California, 22 July 1962 (J. S. Buckett and G. M. Trenam), Bauer-Buckett Slide 62B4-29.

FEMALE.—Antennae simple, ciliate. Thorax lacking fawn-colored or red-brownish hairs at bases of primaries; ordinary lines prominent, simple with exception of geminate transverse anterior line; costal and inner marginal bands less pronounced due to irroration of brown scales; subterminal line creamy yellow. Ventral surface as in male. Secondaries with broader brown band on outer margin than that found in the male; fringes pure white. Ventral surface with broad, brown costal band; brown band present at outer margin. Alar expanse same as male, 15-16 mm.

Most of the specimens examined are located in the Bauer-Buckett

collection, Davis; however, a small series is in the collection of the University of California, Davis. The genitalic illustrations were made by Miss Judith Jay, departmental artist, Entomology Department, University of California, Davis. Appreciation is also due Mr. Gary Trenam for his help in this project.

LITERATURE CITED

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Identity of the Moth, *Euxoa wilsoni*

(Lepidoptera : Noctuidae)

JOHN S. BUCKETT

University of California, Davis

Since the variability of *Euxoa wilsoni* (Grote) has led to much confusion and the original description was based on an aberrant form, the status of this species is reexamined here.

EUXOA WILSONI (Grote)

Agrotis wilsoni Grote, 1873. *Bull. Buffalo Soc.*, 1: 135.

Agrotis specialis Grote, 1874. *Bull. Buffalo Soc.*, 2: 62.

Agrotis aequalis Harvey, 1876. *Canadian Entomol.*, 8: 36.

Euxoa wilsoni Grote, 1903. *Cat. Noctuidae Brit. Mus.*, 4: 204.

By analyzing Grote's original description and a figure of the type, it is possible to identify a Californian coastal species of *Euxoa* as *wilsoni*. The original description was published in 1873. A year later, Grote re-described "*Agrotis*" *wilsoni* once again as the original combination, and this paragraph preceded his description:

I have now received a series of this fine species which is subject to considerable variation. My original description and figure illustrate the form in which the costal region and subterminal space are not differentiated by a paler color. The more usual form resembles *sexatilis* or *subgothica*, on account of the paler coloration of the costal region of primaries.

Smith (1890) under his description of "*Carneades*" *wilsoni* stated,

A pretty and well defined species with no peculiarities, not already enumerated; it varies from luteous to bright red brown, the latter being typical of *specialis*. Mr. Edward's collection shows both forms. The antennal difference noted by Mr. Grote exists in terms only. *Wilsoni* equally has "tufts of bristles on the joints" and at the same time both forms have them "brush-like." The U.S. Museum collection contains a very pretty series of this species showing the very wide range of variation in ground color. Scarcely two specimens are entirely alike, and yet the characteristic appearance of the species is so marked that no mistake is possible in its recognition.

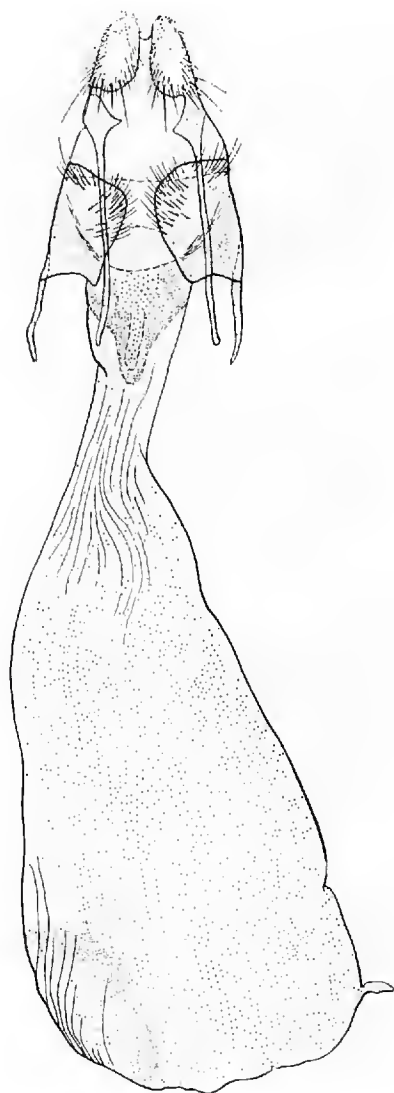


FIG. 1

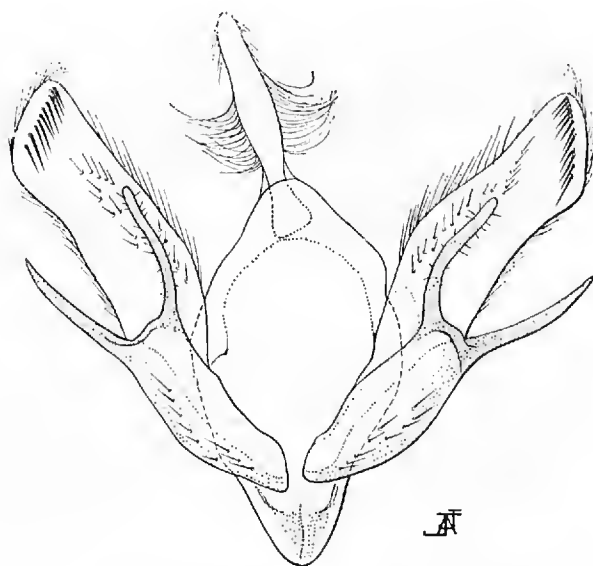


FIG. 2

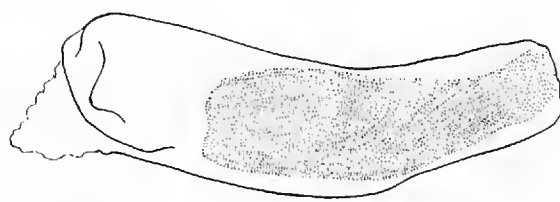
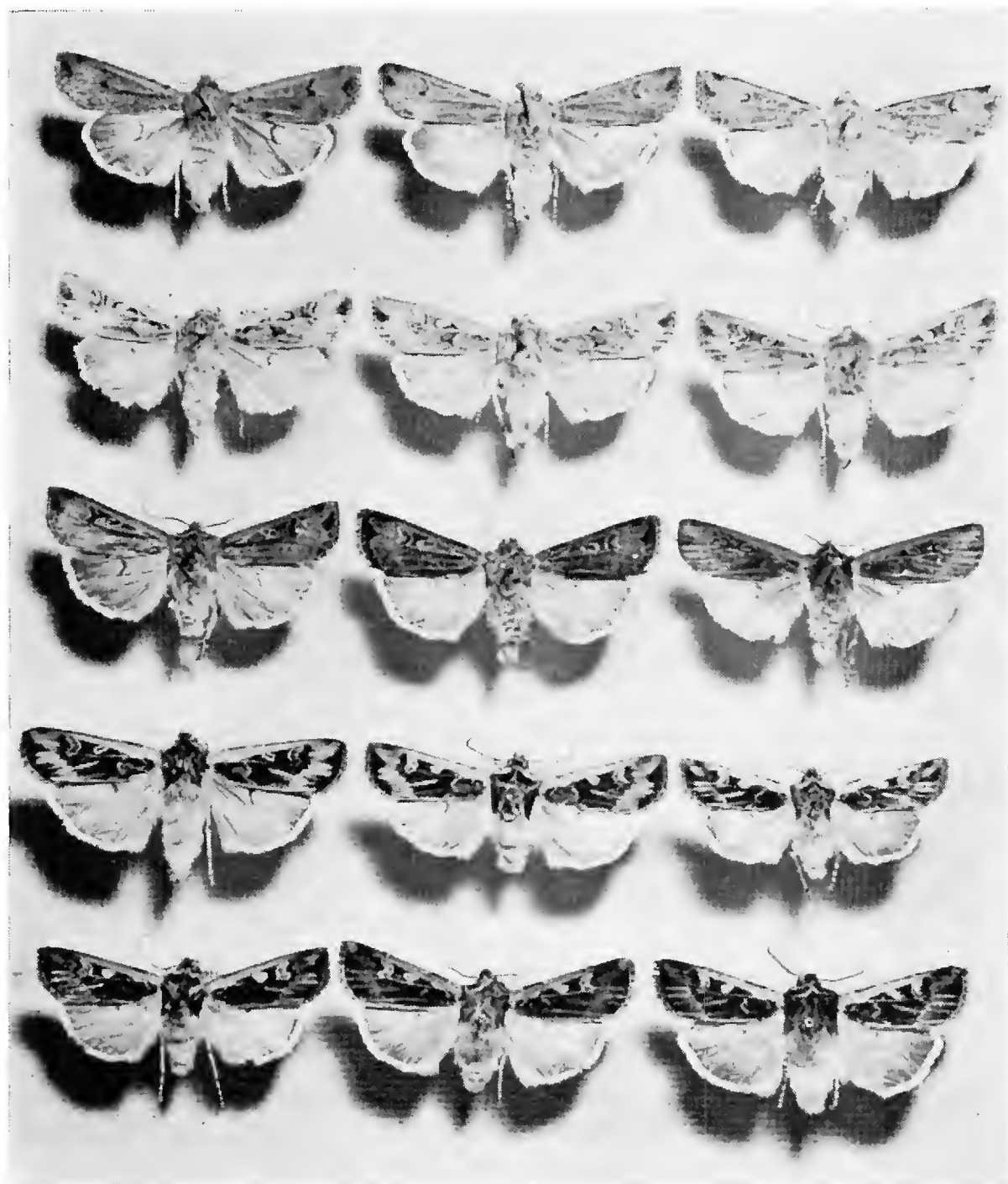


FIG. 3

EXPLANATION OF FIGURES

Figs. 1-3. *Euxoa wilsoni* (Grote). 1, Female genitalia, Dillon Beach, Marin County, California, 10 July 1962 (M. G. Tunzi). 2, Male genitalia minus the aedeagus, Dillon Beach, Marin County, California, 12 July 1962 (M. G. Tunzi). 3, Aedeagus of genitalia shown in Fig. 2; same data as in Fig. 2.

After this statement, Smith treated "*Carneades*" *aequalis* as a separate species on the next page; and after his description further stated, "Apparently a good species allied to *lacunosa*. Entirely unknown to me in nature. I cannot identify it with any of the numerous Californian species known to me." Additional study by later workers proved "*Carneades*" *aequalis* to be conspecific with *Euxoa wilsoni*. The type of *aequalis* as well as that of another species, "*Agrotis*" *specialis* were originally from the same locality: "San Francisco, California" (*teste* Hampson, 1903). "*Agrotis*" *specialis* has been previously synonymized under *Euxoa wilsoni* where it obviously belongs. Hampson also stated in his "habitat" for *wilsoni*: "U.S.A., Colorado, Glenwood Springs, California, 2♂, 3♀, type ♂ speci-



EXPLANATION OF FIGURE

Fig. 4. Variation in maculation of *Euxoa wilsoni* (Grote). All 15 specimens from Dillon Beach, Marin County, California, 12 July 1962 (M. G. Tunzi).

alis and ♀ type, and type *aequalis*, S. Francisco, 1 ♂." Generally, when Hampson placed the word "type" after a locality under his "habitat," it indicated this was the type locality. In this case the indication is that California is the type locality, probably San Francisco.

McDunnough (1938) once again raised *specialis*, and *aequalis*, to the subspecific level, but this was probably based on an inadequate number of specimens for study.

With a series of *wilsoni* before me which numbers over 600 specimens

of both sexes, one can readily see all the described forms and most of the variation the species exhibits. This large series was collected at Dillon Beach, Marin County, California, June and July 1962 (M. G. Tunzi) and is in the Bauer-Buckett collection, Davis. Other specimens studied are from McClure Beach, Marin County, California, and San Francisco, California, and are also in the Bauer-Buckett collection. Additional specimens from both McClure Beach, Marin County, and Dillon Beach, Marin County, are in the collection of the University of California, Davis. A series of 79 specimens which bear the locality label "San Francisco" and the Koebele collection label was submitted for this study by Dr. C. Don McNeill, California Academy of Sciences, San Francisco.

I wish to extend my appreciation to Dr. R. M. Bohart for his many helpful suggestions and to Miss Judith Jay, departmental artist, Entomology Department, University of California, Davis, for the illustrations.

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A New Genus and Species of Mutillidae from California¹

(Hymenoptera : Mutillidae)

CLARENCE E. MICKEL

University of Minnesota, St. Paul

Dr. Jerry A. Powell, University of California, Berkeley, recently sent me a series of male and female Mutillidae and requested that they be identified. The insects were taken crawling on the ground in a large colony of the sphecid, *Xylocelia occidentalis* (Fox). The specimens proved to be examples of a new genus and species, the descriptions of which follow.

Smicromutilla Mickel, new genus

MALE.—Head slightly wider than the thorax; mandibles not emarginate beneath, the ventral margin entire; tips of mandibles edentate and with two small teeth within; eyes subovate, the margins entire, facets distinct; ocelli small, the ocellocular distance three times the width of a lateral ocellus; first abdominal segment subsessile with the second, no noticeable constriction between the first and second segments; width of first abdominal tergum at posterior margin half the greatest width of second tergum; felt lines on tergum two only; abdominal terga without a row of bristles at the posterior margin; stigma of front wings vestigial, inconspicuous; cell 2nd $R_1 + R_2$ broadly truncate; veins R_4 , M_{1+2} beyond R_5 , M_1 and M_2 all obsolete, thus cells R_4 and 1st M_2 open; calcaria pale.

FEMALE.—Head distinctly broader than the thorax; mandibles endentate at the tip, with a single small tooth within, not emarginate nor toothed beneath; eyes subovate, entire, facets distinct; thorax pyriform, widest anteriorly, gradually narrowed posteriorly; first abdominal segment subsessile, the width at the posterior margin slightly less than half the greatest width of the second; pygidial area nitid, not defined laterally; calcaria pale.

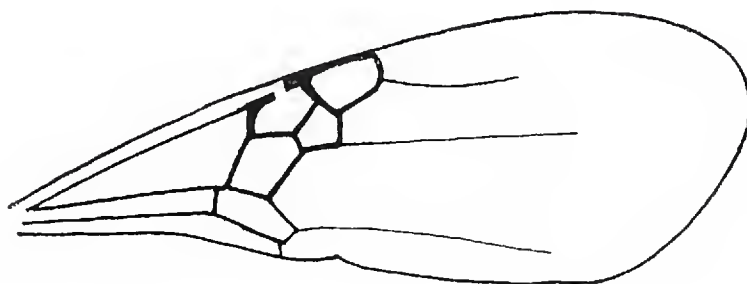
Type of the genus.—*Smicromutilla powelli* Mickel, new species.

Related to *Lomachaeta* Mickel. Differs in the male sex by the mandibles not emarginate nor toothed beneath, by the absence of a row of bristles on the abdominal terga, and by the much more reduced winged venation. The female sex differs in having the anterior and propodeal spiracles not tuberculate.

Smicromutilla powelli Mickel, new species

MALE.—Head, thorax, abdomen, except first and second segments, and legs black; mandibles and tegulae testaceous; first and second abdominal segments ferruginous; pedicel and first segment of flagellum approximately equal in length, the first flagellar segment distinctly shorter than the second; clypeus convex, highest along the

¹ Paper No. 5235, Scientific Journal Series, Minnesota Agricultural Experiment Station, St. Paul, Minnesota.



EXPLANATION OF FIGURE

Fig. 1. Right front wing of male *Smicromutilla powelli* Mickel.

midline, closely punctate and with erect, fuscous hairs; front, vertex, and genae nitid, with sparse, shallow punctures and erect, pale fuscous hairs; genae with large, close, shallow punctures, weakly separated from postgenae; pronotum nitid, with large, close, shallow punctures and erect, pale fuscous hairs; humeral angles rounded; mesonotum nitid, with large, shallow, close punctures and erect, pale fuscous hairs; parapsidal furrows obsolete; scutellum with large, close punctures and erect, pale fuscous hairs; sides of pronotum nitid, mostly impunctate; mesopleurae shallowly reticulate and with erect, pale hairs; metapleurae and sides of propodeum nitid, mostly impunctate; posterior face of propodeum broadly, shallowly reticulate; tegulae well developed, the disk nitid, impunctate; first abdominal tergum nitid, with a band of close punctures at the posterior margin, otherwise sparsely punctate, and with erect, pale hairs; second tergum nitid, with scattered, shallow punctures and erect, pale hairs, the posterior margin with a band of small, distinct punctures and a very thin fringe of pale hairs; felt line of second tergum approximately three-eighths the length of the tergum; terga 3-6 nitid, with sparse, small punctures and erect, fuscous hairs; pygidial tergum sparsely punctate and with erect, fuscous hairs, the pygidial area undefined laterally; first sternum elevated into a carina along the midline; second sternum nitid, with sparse, shallow punctures and sparse, erect, pale hairs; sterna 3-6 with sparse punctures and erect, pale hairs; hypopygium with sparse, erect, fuscous hairs; legs clothed with pale hairs; wings hyaline, venation as in Fig. 1. Length, 3.5 mm.

FEMALE.—Head, thorax, antennal scape, first and second abdominal segments, coxae, trochanters, and proximal fourth of femora all ferruginous, remainder of abdomen, antennae, and legs fuscous to black; clypeus convex and punctate; front, vertex, and genae with shallow, close, somewhat indistinct punctures, and sparse, erect, fuscous hairs; genae and postgenae separated by a distinct carina; dorsum of thorax and posterior face of propodeum broadly, shallowly reticulate and with sparse, fuscous hairs; lateral margins of dorsum of thorax without dentiform elevations at the anterior and propodeal spiracles; humeral angles slightly but distinctly dentate; sides of thorax nitid, impunctate, bare, except a vertical row of punctures and erect hairs in the mesopleural area; first abdominal tergum nitid, with sparse punctures and erect, pale hairs; second abdominal tergum nitid, with scattered, small punctures and erect, fuscous hairs, and with a very thin fringe at the posterior margin; terga 3-5 with small, sparse punctures and erect fuscous hairs; pygidial area nitid, not defined laterally; legs clothed with very sparse, pale fuscous hairs. Length, 2.5 mm.

Holotype male.—POZO, SAN LUIS OBISPO COUNTY, CALIFORNIA, 30 April 1962 (J. Powell), in collection of California Insect Survey.

Allotype female.—POZO, San Luis Obispo County, California, 4 May 1962 (J. Powell), in collection of California Insect Survey. *Paratypes*.—Five males, Pozo, San Luis Obispo County, California, 30 April 1962 (J. Powell); two males, three females, Pozo, San Luis Obispo County, California, 4 May 1962 (J. Powell), in collections of California Insect Survey, United States National Museum, and University of Minnesota.

Superficially resembles species of *Lomachaeta* but the males have the mandibles entire beneath, lack the row of bristles at the posterior margin of the abdominal terga, and have a more reduced wing venation, while the females lack the tuberculate lateral margins of the dorsum of the thorax. One of the male paratypes has the ferruginous color of the abdomen extending entirely through the third segment and the proximal half of the fourth segment.

INSTITUTE OF ACAROLOGY

The Institute of Acarology, offering instruction in general acarology and in agricultural, medical, and veterinary acarology, will be held 22 June to 10 July 1964 at the Ohio State University in Columbus, Ohio.

ZOOLOGICAL NOMENCLATURE: Notice of proposed use of plenary powers in certain cases (A. [n.s.] 61)

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full details of which will be found in *Bulletin of Zoological Nomenclature*, Vol. 20, Part 6, published on 6 December 1963.

- (3) Validation of *Leptocoris* Latreille, 1829 (Insecta, Hemiptera). Z.N.(S.) 1589;
- (7) Validation of a neotype for *Coenonympha ochracea* Edwards, 1861 (Insecta, Lepidoptera). Z.N.(S.) 1607.

Any zoologist who wishes to comment on any of the above cases should do so in writing, and in duplicate, as soon as possible, and in any case before 6 June 1964. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 6 June 1964, be brought to the attention of the Commission at the time of commencement of voting.

All communications on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S. W. 7, England.—W. E. CHINA, *Acting Secretary to the International Commission on Zoological Nomenclature*.

Studies on the bionomics of sphecoid wasps.**I. *Moniaecera asperata***

(Hymenoptera : Sphecidae)

MONT A. CAZIER AND MARTIN A. MORTENSON¹*University of California, Berkeley*

According to Muesebeck, Krombein, and Townes (1951) the genus *Moniaecera* is represented in the fauna of North America only by the typical subgenus. This subgenus is further represented by only five species as follows: *M. abdominalis* (Fox) from Georgia, Texas, and Arizona; *M. asperata* (Fox) from Texas, New Mexico, Arizona, and California; *M. evansi* Pate from Arizona; *M. foxiana* Pate from California; and *M. pinal* from Arizona and California. Of these five species, notes on the behavior, nesting habits, and prey are known only for *M. abdominalis* (Fox) through observations made by Hartman (1905) at a location near Austin, Texas.

In this location Hartman found *M. abdominalis* to be abundant in August and September where they were seen flying around low vegetation in a wooded area. He also observed that while hunting on the vegetation this wasp makes frequent contact with the leaves, sticks, and blades of grass with its antennae while evidently searching for its prey. The prey was found to consist exclusively of the leafhopper *Tylozygus bifidus* (Say). The entrance to the nest was a tiny hole in the middle of a small, flat elevation in the sand. The burrow extended nearly horizontally for 2.5 inches then nearly vertically for 0.4 inch, ending in a small pocket or cell at the bottom in which there were a number of leafhoppers but no wasp egg. The burrow had a uniform diameter of 2 mm.

The following observations on *Moniaecera asperata* were made on a study plot located two miles northeast of Portal, Cochise County, Arizona, elevation 4700 feet, between 28 May and 6 June 1962. During this period numerous specimens were observed flying slowly and erratically just above the surface of the ground, 2–10 inches, in open areas between the following plant species: *Prosopis juliflora* (Swartz) DC. (mesquite), *Flourensia cernua* DC. (tar-bush or varnish-bush), *Larrea tridentata* (DC.) Caville (creosote-bush), *Parthenium incanum* H. B. K. (mariola), *Salsola kali* L. (Russian-thistle), *Verbesina encelioides* (Cav.) Benth and Hook (crown beard), *Baileya multiradiata* Harv.

¹ Department of Entomology and Parasitology. Currently Visiting Professor and Laboratory Technician respectively, Arizona State University, Tempe, Arizona. This project was supported in part by National Science Foundation Grant GB-379.



EXPLANATION OF FIGURE

Fig. 1. Burrow entrance of *Moniaecera asperata* (Fox).

and Gray, *Gutierrezia microcephala* (DC.) Gray (snake-weed), and *Solanum elaeagnifolium* Cav. (white or silver horse-nettle). No wasps were observed landing on either the plants or the sandy ground in the open areas between them.

The breeding site was located adjacent to the area described above in a shallow borrow-pit from which the plants and topsoil had been scraped exposing the rocky, hard-packed, caliche layer beneath (Fig. 1). The burrow entrance was located about one-half inch from the edge of a small rock; the opening was irregular in shape (Fig. 1) and measured 4 mm across its widest diameter. There was no sign of excavated dirt around the entrance which was flush with the gently sloping surface.

Immediately inside the entrance the burrow became rounded in shape and varied only slightly from being 4 mm in diameter for its entire length. The first two inches of soil were hard packed and dry but below this level it was loose and slightly moist. The burrow went straight down for 50 mm, angled slightly toward the south, and continued

downward at a steep angle for another 55 mm to the first cell. This cell projected off the main burrow on the west side and the main burrow continued on downward for another 10 mm. No evidence of either the main burrow or additional cells was found below this 115 mm depth.

The female was first observed entering this burrow on 1 June 1962 and was seen going in and out several times on this date. Similar observations were made on 5 June 1962 during which time she was seen to fly almost directly into the burrow carrying green-colored prey. There was little or no hesitation at the burrow entrance. On 5 June 1962 at 1:30 p.m. she was collected as she came in carrying an adult psyllid and the burrow was excavated on 6 June 1962.

The cell that had evidently been completed and sealed off from the main burrow was found to contain three specimens of *Circulifer tenellus* (Baker), the beet leafhopper; 10 specimens of *Empoasca abrupta* DeLong, the western potato leafhopper; a fragment of one psyllid identified by Miss Russell as a species of *Paratrioza*; two specimens of a new species of psyllid belonging to the genus *Aphalaroida* that breeds on *Prosopis* (Jensen reference number J. 332); a large wasp larva that was injured in digging; and the remains of a number of leafhoppers. Judging from the size of the adult *M. asperata* (Fox) this larva was nearly mature and ready for pupation even though there were still 13 leafhoppers and two psyllids available in the cell. There was no evidence of a second egg on any of these specimens. One *Empoasca abrupta* DeLong was found at the bottom of the main burrow and the female was caught carrying a specimen of *Aphalaroida* n. sp. She was probably getting ready to stock another cell and evidently piles the prey up at the end of the burrow before excavating the cell.

In summary: (1) *Moniaecera asperata* (Fox) uses species in both the families Cicadellidae and Psyllidae as prey. (2) The first or shallowest cell is the oldest. (3) There are evidently a number of cells in each burrow. (4) The paralyzed prey are accumulated at the end of the burrow before being placed in a cell. (5) *M. asperata* unlike *M. abdominalis* digs its burrow nearly vertical, at least in the upper portions.

ACKNOWLEDGMENTS

The writers would like to express their sincere appreciation to the following individuals for their assistance in this project: Dr. Karl V. Krombein, James P. Kramer, Miss Louise M. Russell of the Entomological Research Division and United States National Museum, Washing-

ton, D. C., Dr. M. W. Nielson, Entomological Research Division, U.S.D.A., Mesa, Arizona, Drs. D. D. Jensen, Ray F. Smith, Paul D. Hurd, Jr., and E. G. Linsley of the University of California, Berkeley.

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A Note on the Prey and Nest Structure of *Stigmus inordinatus inordinatus*

(Hymenoptera : Sphecidae)

MARIUS S. WASBAUER AND WILLIAM E. SIMONDS

California Department of Agriculture, Sacramento

Early in 1962, a shipment of two small, black, sphecoid wasps was submitted to the California Department of Agriculture Insect Identification Laboratory. They were collected at Santa Paula, Ventura County, California, 2 February 1962, by B. Osuna. Associated with the wasps were pieces of peony twig (*Paeonia suffruticosa*) and apterous forms of a small aphid.

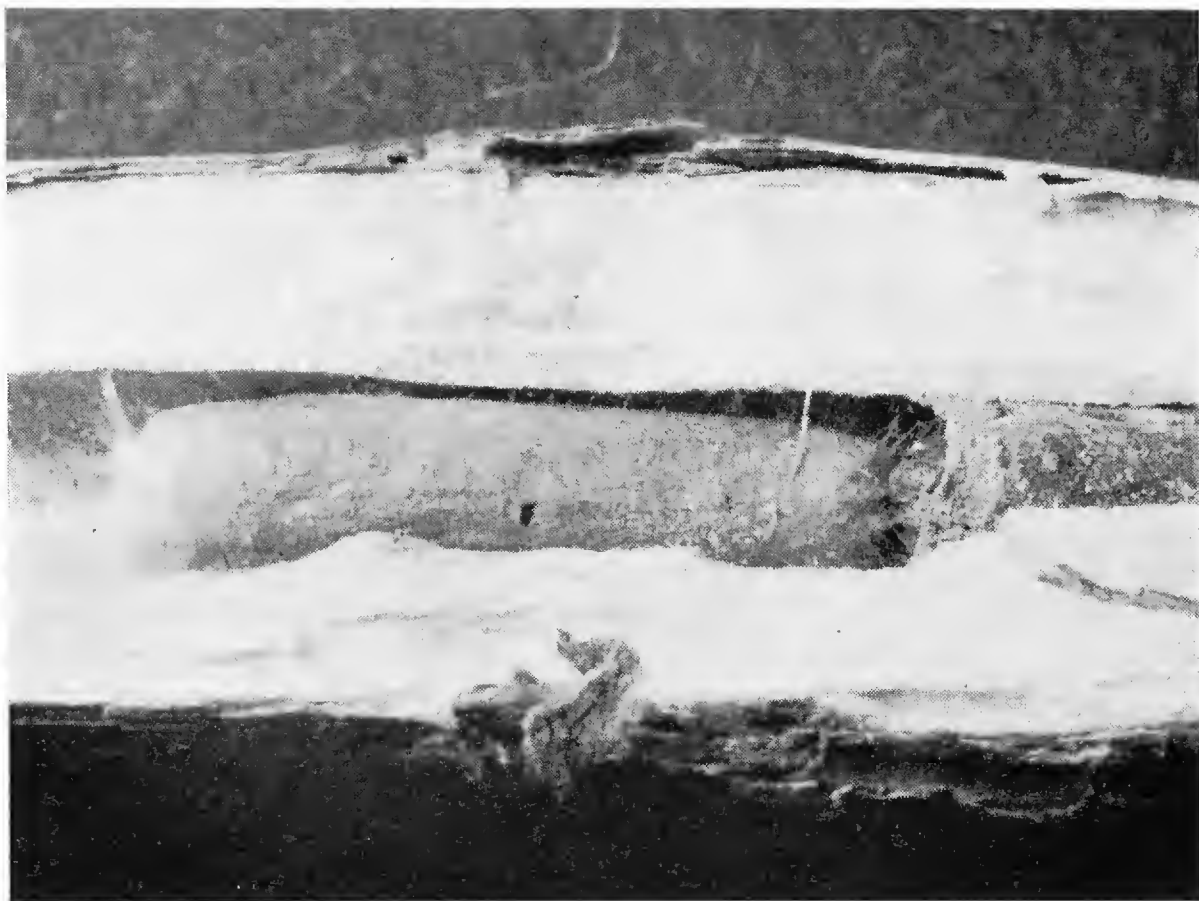
Subsequently, additional material was sent to us which included a longer series of the sphecoid, the twigs from which they were reared, and many more aphids which were found packed in cells in some of the twigs. The twigs of mulberry (*Morus alba*) were present in the shipment and a note from the collector stated that the wasps were nesting in mulberry to an even greater extent than in peony.

Our preliminary determination of the wasp showed it to be a member of the genus *Stigmus*. It was then sent to Dr. K. V. Krombein, who determined it as *Stigmus inordinatus inordinatus* Fox, an austral form occurring in Colorado, New Mexico, Arizona, and California. The aphid proved to be the *Aphis* sp. possibly *frangulae* Kaltenbach (apterous forms only) according to the determination by L. M. Russell.

The one published note on the biology of *Stigmus i. inordinatus* (Rohwer, S. A., 1909, Trans. Amer. Entomol. Soc., 35: 102) states only that Mrs. Cockerell saw a member of this form catch aphids. Thus the fragmentary information presented here will fill out to some degree the almost complete lack of biological data on this species.

A total of seventeen twigs was examined for nesting activity. Of these, five were empty, four contained cells completed and provisioned, and, in the remainder there was some evidence of the development of the wasp. In all of the twigs, the pithy center had been hollowed out, leaving a gallery of relatively uniform diameter, which averaged 2.0 (1.3–3.0) mm. In the twigs of smaller diameter, the pith had been completely removed. No estimate of the depth of the galleries was attempted, since all of the twigs had been cut off before the termination of the burrow.

A linear arrangement of cells was found in some of the twigs. The cells were formed of partitions made across the main gallery. In all cases, the partitions were composed of small bits of pith. They varied in thickness from 5.0 to 8.5 mm. The cells formed by these partitions were from 4.5 to



EXPLANATION OF FIGURE

Fig. 1. Cocoon of *Stigmus inordinatus inordinatus* Fox in twig of *Morus alba*.

9.0 mm in length. There was some individual variation in cell construction. In the gallery having the thickest partition (8.5 mm), for example, most of the partitions were unusually thick (2.5, 4.0, 8.5, 4.5, 1.5, 1.0 mm). The gallery containing the thinnest partition (0.5 mm) had most partitions somewhat thinner (1.0, 0.5, 1.5, 1.5 mm). Cell length was relatively uniform within a gallery, but varied considerably between different galleries. For example, cell lengths in one gallery were 4.0, 3.5,

3.5, and 2.4 mm. In another of about the same diameter, the length of the cells was 7.0, 6.0, 7.0, 9.0, and 7.0 mm.

It was difficult to determine the number of aphids provisioned in a cell, because of a growth of mold which had formed a solid mat over the prey in cells not containing wasps. Of the four twigs containing galleries with fully provisioned cells, aphid counts could be made in two. The first of these contained four cells with 12, 14, 15, and 16 aphids. The second, also containing four cells, had 20, 26, 29, and 30 aphids.

The cocoons (Fig. 1) were elongate and nearly cylindrical but tapering slightly toward the posterior end. They were composed of a single layer of a very thin, flexible parchment-like material. Attached to the outside of the cocoons were numerous short strands of clear silk, probably the remains of a suspensory network. At the anterior end, the strands were more dense and formed a thin, slightly convex partition. The meconium formed a small, black button at the posterior end of the cocoon. One of the two cocoons remaining intact was 9.2 mm in length, 2.0 mm in width at the anterior end and 1.7 mm at the posterior end. The other was 8.7 mm long, 2.0 mm wide at the anterior end, and 1.2 mm at the posterior end.

SCIENTIFIC NOTE

Occurrence of *Drosophila azteca* in a spittlebug mass (Diptera: Drosophilidae).—Dipteran pupae were found in spittle masses of *Aphrophora canadensis* Walley (Homoptera, Cercopidae) in 1963 (from M.S. thesis, Department of Entomology and Parasitology, University of California, Berkeley). Dr. Marshall R. Wheeler, University of Texas, determined the flies reared from the pupae as *Drosophila azteca* Sturtevant and Dobzhansky. As far as is known, this is the first report of an association of this species of *Drosophila* with spittlebug nymphs. According to Dr. F. R. Cole (personal communication), Consultant in Entomology, University of California, Berkeley, the fly *Clastopteromyia inversa* (Walker) (generotype *Drosophila inversa* Walker) is known to be ectoparasitic on the nymphal spittle insects of the genus *Clastoptera*: *Clastoptera obtusa* (Say) on alder in the east, and *Clastoptera lineatocollis* Stål on various plants in California. Dr. Cole kindly supplied this information from his forthcoming manuscript, "Flies of Western North America."—W. E. KELSON, Mt. Diablo High School, Concord, California.

**Parasitic Flies of the Genera *Helioprosopa*
and *Euhelioprosopa*¹**

(Diptera : Tachinidae)

H. J. REINHARD

Texas A & M University, College Station

The genus *Helioprosopa* was described by Townsend in 1926 with *facialis* as the type by original designation (Gen. Musc. Hum. Trop. Am., 239). The latter citation is in Portuguese and in the form of abbreviation symbols difficult of interpretation. However, a redescription of the genus by its author in 1939 makes it more readily recognizable without access to the type series, which is from Brazil (Manual of Myiology, Part VIII, 195).

Hitherto the genus here under consideration has not been referred to in either taxonomic or economic literature citing information regarding host relationships. During recent years materials received for identification have brought to light six additional undescribed, apparently congeneric, species and a closely allied new genus. All are included in the accompanying key and described on following pages. The new species are represented by limited series from Mexico, Colombia, Brazil, and Chile. This wide range of the known species indicates that perhaps members of the genus may prove quite common in the Neotropical fauna.

I am indebted to Dr. Paul H. Arnaud, Jr., for the loan of pertinent material and all types based upon the latter are returned to the California Academy of Sciences Collection.

GENUS HELIOPROSOPA Townsend

Helioprosopa includes smallish to average-sized cuphocerine flies of fairly compact build. With few exceptions the present known forms are basically black in color with apex of abdomen more or less reddish. The peculiar or more distinctive generic characters may be summarized briefly as follows:

Head with ocellar bristles and palpi absent; parafacial setose with one or more facioorbitals below; epistoma nasutely produced; second antennal segment normally at least one-half length of third; arista micropubescent, thickened to near tip, penultimate segment elongated, the proximal usually short; cheek over one-half eye length; *propleura* bare; *wing* gray hyaline to strongly infuscated; first vein bare, third setulose to or nearly to small cross vein; last section of fifth vein two-fifths or more length of preceding; first posterior cell open well before wing tip; calypters

¹ Contribution No. 4318, Department of Entomology, Texas Agricultural Experimental Station, College Station, Texas.

large, hind lobe transverse; *abdomen* with intermediate segments usually without discs; sternites exposed and bristled.

The remaining characters which apply in common to the species here under consideration are cited below for convenient reference and avoidance of repetitious details under the accompanying descriptions.

Head squared below, two-thirds to three-fourths wider than high, frontal profile shorter to subequal concave facial, antennal axis near to slightly below eye middle and obviously shorter than oral; clypeus flush and transversely convex; vibrissae decussate on oral margin; facialia flattened, at most two bristles and setae next to vibrissae; haustellum-labella length normally under head height; frontal rows doubled in male reaching to middle of second antennal segment; two large proclinate orbitals in female and two equally large verticals in both sexes, inner pair decussate; eye bare, its lower margin far short of vibrissal level; occiput convex and moderately produced behind oral cavity, clothed with pale pile and margined above with a single row of postocular cilia.

Thoracic chaetotaxy: humeral 4-5; posthumeral 2; notopleural 2; presutural 2; supraalar 3; intraalar 2 or 3 (anterior one sometimes absent); dorsocentral 3, 3; acrostichal 2, 3; postalar 2; sternopleural 3; pteropleural doubled (largest equal to sternopleural); scutellum with two strong lateral (which reach beyond base of third abdominal segment); 1 good-sized decussate apical and 1 appressed discal pair; prosternum and postnotal slope bare. *Legs* of male with claws and pulvilli normally subequal to length of last tarsal segment, shorter in female; latter with simple or unmodified foretarsi. *Wing* reaching beyond apex of abdomen; hind cross vein oblique in plane of apical and one-third or more its length from rectangular cubitus, which bears a short stump or fold about two-fifths wing width from hind margin; costal spine vestigial.

Abdomen ovate, as wide as thorax in male but wider than same in female; one pair median marginals on segment two, a marginal row and at times weak discs on three, one row of small marginals and one or more rows of stronger discs on segment four; female genitalia without piercer.

KEY TO SPECIES OF HELIOPROSOPA AND EUHELIOPROSOPA

1. Propleura bare, ocellars absent *Helioprosopa* Townsend, 2
 Propleura setose, ocellars present *Euhelioprosopa pactilis*, n. gen. et n. sp.
2. Calypters white to tawny or yellow 3
 Calypters black 6
3. Cheeks and parafacials black-haired 4
 Cheek and parafacial vestiture golden; abdomen rusty yellow, with discs
 on intermediate segments; parafrontal vestiture black, female only (Colom-
 bia) *aurifodina*, n. sp.
4. Notal vittae broad and well defined to scutellar base 5
 Notum subshining, vittae barely visible before and wholly obliterated behind
 suture; parafrontals black and sharply delimited from pale or reddish para-
 facials at level of lower frontals; antennae red; claws and pulvilli shorter than
 apical tarsal segment (Mexico) *electilis*, n. sp.
5. Parafacials silvery on infuscated background, bearing three facioorbitals and
 a vestiture of longish black hairs on outer half of entire length; sternopleura

- black-haired, male only (Chile) *finita*, n. sp.
 Parafacials overlaid with heavy golden pollen on pale background, bearing one facioorbital and clothed with shorter sparser black hairs; sternopleura in male pale-haired on lower half (Brazil) *facialis* Townsend
6. Abdomen and legs predominantly black 7
 Abdomen and legs except tarsi reddish yellow; parafacials subsilvery, sparsely microsetose on outer margin; third antennal segment entirely black, uncommonly broad and long, female only (Colombia) *macrocera*, n. sp.
7. Abdomen polished black, anal segment red-tipped and tawny pollinose on basal half at sides, hairs on upper surface of intermedian segments short and appressed; clypeus and epistoma silvery on pale ground color (Mexico, Colombia) *liciata*, n. sp.
 Abdomen opaque black with shiny rounded areas surrounding bases of all macrochaetae, without any pale pollen, hairs on upper surface long and erect; clypeus and epistoma blackish in ground color, female only (Colombia)
 *veleda*, n. sp.

***Helioprosopa aurifodina* Reinhard, new species**

A wholly reddish-yellow species with concolorous legs and tawny calyp-
 ters.

FEMALE.—*Head* with dense old gold pollen on a wholly pale background; front at vertex 0.36 of head width, diverging rapidly into facial angle; frontalia narrowed upwards, exceeding width of parafrontal; frontal row single, two bristles below antennal base; three proclinate frontoorbitals and one facioorbital; antenna red, third segment largely infuscated and barely over length of second; brownish arista pubescent to tip; cheek three-fifths eye length; haustellum moderately slender but under head height; occiput slightly darkened on lateral margin above, clothed with golden pile.

Thorax largely pale in ground color, notum darker and dusted with opaque gold pollen and indistinctly vittate; scutellum wholly red, bearing strong lateral bristles and with erect black hairs on disc, no well-differentiated discals. *Wing* largely gray hyaline but with a yellow tinge costobasally; veins reddish yellow, third setose to small cross vein; hind cross vein less than half its length from V-shaped stumpless cubitus; last section of fifth vein well under one-half length of preceding section; epaulet, subepaulet, and halteres pale red to yellow. *Legs* strongly black-bristled; yellow, black-tipped claws and pale pulvilli shorter than last tarsal segment; foretarsus stout, unmodified.

Abdomen rusty yellow with an elongate black macula along median line on anal segment, entire upper surface opaque without pollen and semitranslucent basally at sides and on venter; one pair of discals on segments two and three besides a complete marginal row on latter; anal segment bearing three irregular discal rows and a marginal row reduced to small hairs at middle above; blunt-tipped genitalia black and closely retracted within tip of abdomen; sternites exposed and well bristled.

MALE unknown.

Length, 9.5–11 mm.

Holotype female.—6 MILES WEST OF CALI VALLE, COLOMBIA, 1,630 m,

20 March 1955 (E. I. Schlinger and E. S. Ross). Paratypes: 3 females, same data as type, all in the California Academy of Sciences Collection.

***Helioprosopa electilis* Reinhard, new species**

MALE.—*Head* basically bicolored, occiput and parafrontals black, face including sides and cheeks contrasting red, thin, whitish pollen sheen on front becoming denser and more lustrous on parafacials and cheeks; frontalia red, not equal parafrontal width at mid front level; front at vertex 0.41 of head width; frontals descending about to apex level of second antennal segment; third antennal segment suborbicular infuscated on narrow outer margin, one and one-half times length of second; black pubescent arista thickened to near apex, penultimate segment two or three times longer than thick; haustellum slender but well under head height; cheek four-fifths eye length, sparsely beset with black bristly hairs; occiput clothed with white pile.

Thorax and scutellum bluish black with feebly shining surface lightly dusted with rather uniform gray pollen which in favorable light shows four vague, dark dorsal vittae; chaetotaxy as cited above, but with only one pair of postacrostichals (pre-scutellars) well developed. *Wing* grayish hyaline; veins brown, third setulose to small cross vein; bisinuate hind cross vein three-fifths its length from rectangular cubitulus; last section of fifth vein a little under one-half length of preceding; epaulet rufous, subepaulet paler reddish yellow. *Legs* black, tibiae more or less rufous; claws and pulvilli shorter than last tarsal segment.

Abdomen black, apex red, last three segments above with thin, patternless gray pollen extending thinly to or near hind margin of each; marginal row of bristles on third segment incomplete, main discal row on anal segment strongly arcuate along line of color demarcation; genital forceps wholly yellow, fused base obviously wider than long and black-haired behind, tapered apical part sharply recurved; accessory process with only the narrow polished tip visible in profile; fifth sternite lobes beset with long black bristly hairs.

FEMALE.—Vertex 0.40 of head width; antenna wholly red, third segment longer than broad; anal orifice caudoventral, rounded posteriorly and strongly tapered cephalad, blunt-tipped genitalia retracted. Other details as in male.

Length, 6.5 mm.

Holotype male and allotype female: COLIMA, COL., MEXICO, 27 March 1934.

***Helioprosopa macrocera* Reinhard, new species**

The bicolored habitus and large antennae readily distinguish this species from its congeners.

FEMALE.—*Head* with face, including sides and cheeks, silvery white on pale ground color, parafrontals contrasting black lightly dusted with pale pollen and clothed with fine, short black hairs; frontalia velvety black, about one-third parafrontal width; frontal vertex 0.41 of head width; antenna subequal length of face, third segment wider than length of second and nearly five times longer than same; arista pubescent and thickened to near tip, second segment about three times longer than thick; shining brown hard-textured proboscis barely one-half head height; cheek three-

fourths eye length, sparsely clothed with fine, short black hairs; occiput cinereous on dark background, with a moderately dense vestiture of white pile.

Thorax black, gray pollinose, notum marked by four slender, black vittae, inner pair obsolete shortly behind suture, scutellum wholly red with two strong laterals and no discals. *Wing* brownish to black with narrow hind margin slightly paler; hind cross vein four-fifths its length from cubitulus; last section of fifth vein slightly over one-third preceding section; veins black, third setulose nearly to small cross vein; epaulet and subepaulet reddish; calypters black. *Legs* red, tarsi black; mid tibia with six anterodorsal bristles of unequal size; foretarsus stout but not noticeably dilated; red, black-tipped claws short.

Abdomen red, last three segments black maculate medianly above on basal half (less on anal), surface without pollen and feebly shiny; marginal row on third segment complete and two discal rows of anal; genitalia retracted with blunt tip of apical segment briefly exposed; sternites more widely exposed than in allied forms. MALE unknown.

Length, 10.5 mm.

Holotype female: COLOMBIA, SOUTH AMERICA, without specified locality or collector. An ancient but well-preserved specimen received for identification bearing a single, hand-written label "11302."

***Helioprosopa finita* Reinhard, new species**

MALE.—Front at vertex 0.43 of head width; parafacials and parafrontals concolorous black; third antennal segment subtriangular and strongly convex on front margin from base to lower apical extremity; arista thickened to tapered tip, first segment more elongated than usual and subequal to length of second; cheek three-fourths eye length, clothed with only weak bristly hairs.

Thoracic chaetotaxy as in *H. facialis* except front intraalar bristle lacking in the one available specimen. *Wing* subhyaline, veins including costa reddish; hind cross vein one-half its length from cubitulus; epaulet black. *Legs* black, claws and pulvilli fully equal to length of last tarsal segment.

Abdomen black sides of intermediate segments rufous and apical half of fourth orange red, each with silvery pollen above on basal half or less; hypopigium small, retracted in repose; genital forceps as broad as long on basal half or more, thence suddenly reduced to a narrow acute-tipped beak, hind surface of base punctate and rather thickly clothed with long, fine, black hairs; free part of accessory process shining brown, recurved and subpointed at apex; fourth sternite black, devoid of bristles, fifth with a median U-shaped excision, black lobes bristled. FEMALE unknown.

Length, 10 mm.

Holotype male: CHILE, COQ. 5 MILES NORTH OF LAGUNA DAM, 8,000 feet, 6 December 1950, Ross and Michelbacher, in the California Academy of Sciences Collection.

***Helioprosopa velda* Reinhard, new species**

An opaque velvety black species in which all abdominal macrochaetae, including discals on intermediate segments, are surrounded at base by

small, rounded, polished areas, which are apparent only under magnification.

FEMALE.—*Head* black in ground color, cheek, face, and parafacial gray to silvery, parafrontal deep black and subshiny with a pruinose sheen apparent in most views; red frontalia narrowed upwards and becoming blackish before vertex, about three-fifths parafrontal width at mid front level; frontal row extending two bristles below antennal base; front at vertex 0.43 of head width; antenna black rather slender, third segment nearly twice length of second; black arista pubescent, moderately thickened and tapered to near tip, second segment three or four times longer than wide; parafacial black-haired with one strong facioorbital below; eye bare, reaching a little short of vibrissal level; cheek one-half eye length, sparsely clothed with fine black hairs; haustellum slender and well over head height; occiput pale pilose.

Thorax grayish pollinose before and immediately behind suture, remainder of notum including scutellum without any pale pollen. *Wing* smoky to black near base; veins reddish brown, third setulose halfway or more to small cross vein; last section of fifth vein barely two-fifths length of preceding; hind cross vein slightly over one-third its length from rectangular cubitus, which bears a short fold in membrane; halteres, epaulet, subepaulet, and calypters jet black. *Legs* black, tibiae more or less reddish and strongly bristled; foretarsus simple; claws and pulvilli shorter than last tarsal segment.

Abdomen broadly ovate and wider than thorax, clothed with longish, erect, black hairs on entire upper surface with stout discals on each intermediate segment and three or more irregular discal rows on last; a marginal row of 12 to 14 large, erect bristles on segments two and three; genitalia retracted, terminating in a blunt-tipped ovipositor; sternites exposed and well bristled. **MALE** unknown.

Length, 9.5 mm.

Holotype female: FUSAGASUGA, CUNDINAMARCA, COLOMBIA, SOUTH AMERICA, 10 September 1943 (H. Osorno).

HELIOPROSOPA FACIALIS Townsend

Helioprosopa facialis Townsend, 1926, Gen. Musc. Hum. Trop. Amer., p. 239.

Townsend, 1939, Manual of Myiology, Part VIII, p. 195.

MALE.—The principal distinctive color items are cited in the accompanying key; *head* with antennal segments one and two orange red, third contrasting black, nearly as wide as long and gently convex on anterior margin; arista black with second segment scarcely over twice length of first; cheek one-half to three-fifths eye length, front at vertex 0.38 and at lunule 0.51 of head width; postocellars well developed; haustellum–labella length about three-fourths head height.

Thorax and scutellum black, dusted with gray pollen, notum marked with four broad, well-defined subshiny black vittae. *Wing* gray hyaline, veins brown, third setulose to small cross vein; last section of fifth vein one-half length of preceding; calypters opaque white; epaulet red, subepaulet pallid. *Legs* black, tibiae somewhat reddish and strongly bristled.

Abdomen black, apical half of anal segment orange red; three proximal segments dusted with changeable silvery pollen on basal margin above but denser and less lustrous on venter of each; hairs on upper surface appressed; hypopygium small

and retracted; fourth sternite red, devoid of any vestiture, fifth black, with a deep median excision, lobes clothed with black bristly hairs.

FEMALE.—Front at vertex 0.37 of head width; two proclinate orbitals; third antennal segment over twice as long as wide; cheek nearly three-fifths eye length; foretarsus with intermediate segments flattened and distinctly widened; claws and pulvilli short.

Length, 7.5–11.5 mm.

Redescribed from four males and four females in Dr. Paul Arnaud's collection, all labeled Nova Teutonia, Brazil, January to December 1958–1959 (Fritz Plaumann); and 1 male, same data, except dated 8 May 1952. The latter specimen was compared with the type in the U. S. National Museum.

***Helioprosopa liciata* Reinhard, new species**

MALE.—*Head* with parafrontals bluish black, thinly pale pollinose and clothed with a vestiture of long, erect, black hairs; frontalia opaque brown, scarcely one-half of parafrontal width; front at vertex 0.39 of head width; antenna black, apex of second base of third segment reddish on inner face, latter approximating twice length of second; pubescent black arista thickened on basal three-fifths, with penultimate segment elongated; cheek nearly three-fifths eye length; slender, shining brown haustellum over one-half head height; occiput cinereous on dark background clothed with dense white pile.

Thorax and scutellum shining black, lightly sprinkled with whitish pollen appearing densest in a flat rear view; notum showing four faintly marked vittae and clothed with a vestiture of fine, black, erect hairs. *Wing* smoky, veins yellow to brown, third setose halfway to small cross vein; last section of fifth vein barely one-third length of preceding; hind cross vein two-fifths its length from cubitus; latter without any appendage, epaulet black, subepaulet orange red. *Legs* black, strongly bristled; claws and pulvilli subequal to last tarsal segment.

Abdomen ovate, broader and longer than thorax, genitalia similar to *H. finita* but the fused base of forceps narrower and accessory process largely concealed by the convex orange-red side of second genital segment; sternites narrowly exposed and bristled except fourth, lobes of fifth sternite clothed with fine black hairs.

FEMALE.—Front at vertex 0.39 of head width; third antennal segment narrower and straight on front margin; claws and pulvilli shorter than apical tarsal segment, anal orifice broadly ovate, genitalia retracted.

Length, 8.5–9 mm.

Holotype male: "7 MILES NORTHEAST OF JACALA, HIDALGO, MEXICO, 27 July 1954," no collector's label. *Allotype female*: Fusagasuga, Cundinamarca, Colombia, South America, 10 September 1943 (H. Osorno).

***Euhelioprosopa* Reinhard, new genus**

This genus, based upon the type species *E. pactilis* described below, closely approximates the habitus of *Helioprosopa* (type, *facialis* Tns.),

but differs in the pertinent characters cited in the accompanying key and in others listed in the following description.

***Euhelioprosopa pactilis* Reinhard, new species**

MALE.—*Head* with parafacials, clypeus, and cheeks yellow pollinose on pale background; parafrontals subshiny black, lightly sprinkled with pale pollen; front strongly narrowed toward vertex which measures 0.30 of head width; frontalia concolorous with parafrontal and narrower than same; frontal rows doubled on widest part of front, three or four bristles below antennal base; proclinate ocellars equal to size of average frontal; parafacials black-haired along narrow outer margin and bearing two strong facioorbitals; cheek one-half eye length; third antennal segment black, strongly arched on front edge from base to apex and one-fourth longer than second; penultimate arisal segment one-fourth length of third; occiput with a ruff of pale yellowish white pile.

Thorax marked above with complete black vittae, scutellum concolorous. *Wing* slightly infuscated; third vein with three or four setulae near base; last section of fifth vein about one-third length of preceding; calypters pale; epaulet blackish and sharply contrasted with subepaulet. *Legs* wholly black; mid tibia with three unequal anterodorsal bristles; claws and pulvilli subequal to last tarsal segment.

Abdomen black, apex orange red; one pair of median discals on intermediate segments and three irregular rows of discals on anal; hypopygium largely retracted in repose, fused forceps strongly compressed, arched in profile and scarcely narrowed apically, bluntly rounded on apex; accessory process extending briefly forward from thick base thence sharply recurved and tapered to a narrow black-polished apex; fifth sternite black, lobes clothed with whitish pubescence and scattered black hairs. **FEMALE** unknown.

Length, 9 mm.

Holotype male: "Chile: 50 KILOMETERS SOUTH OF LASORENA, 2 December 1950, Ross and Michelbacher," in the California Academy of Sciences Collection.

MEETING ANNOUNCEMENT

The annual meeting of the Pacific Branch of the Entomological Society of America will be held 15–18 June 1964 at the Edgewater Inn, Marina Hotel, Long Beach, California. Among the topics to be presented are symposia on food selection by insects and on insect pheromones.

Notes on the Nesting Site of *Centris derasa*

(Hymenoptera : Apoidea)

FRED D. BENNETT

Commonwealth Institute of Biological Control, West Indies

In June 1962 Mr. S. Ramsumair, Entomology Department, University of the West Indies, mentioned that on several occasions he had found larvae and pupae of a large bee in the nests of an arboreal termite. In his company I opened a few termite nests in which we found several empty cells of the same type from which he had obtained his specimens. During the next few months I opened several nests and arranged to have my assistant, Mr. D. Bharath, open additional ones. Although many nests contained old empty cells, it was not until October that a cell containing a living larva was found. Attempts to rear larvae from opened cells were unsuccessful and, although 50 undisturbed termite nests were patrolled at weekly intervals for several weeks, no sign of bee activity was noted until 28 December when Mr. Bharath found a termite nest from which the abdomen of a bee protruded. The bee was dead and had been attached firmly to the nest by the termites. It had been dead for only a day or so as the abdomen was still flexible. Although damaged considerably when removing it from the nest, it proved to be the same species as two females caught in October around the yellow flowers of *Cassia multijuga*. These specimens were subsequently identified by specialists at the Commonwealth Institute of Entomology as *Centris derasa* Lepeletier. Termites from several of the nests were determined as *Microcerotermes arboreus* Emerson by Mr. W. E. Harris. A description and illustration of the nest of this species have been provided by Adamson (1937). An additional female captured later in its tunnel within a termite nest was also determined as *Centris derasa* by Padre Jesus S. Moure, C. M. F., Universidad do Paraná, Curitiba, Brazil.

Records were kept on the termite nests opened during the period September 1962 through May 1963 and the number containing cells, the total number of cells, the nest with the largest number of cells, and the cells containing immature stages being noted. This information is summarized in Table 1. As large termite nests may be several years of age, cells constructed throughout this period were present and recognizable. For example, the nest containing the greatest number of *Centris* cells (150) was very large and possibly more than 5 years old. Although the cells may be occupied by the termites after the emergence of the bees, the cell walls remain more or less intact and are readily recognizable when a nest is dismantled. The number of provisioned cells found during dissection

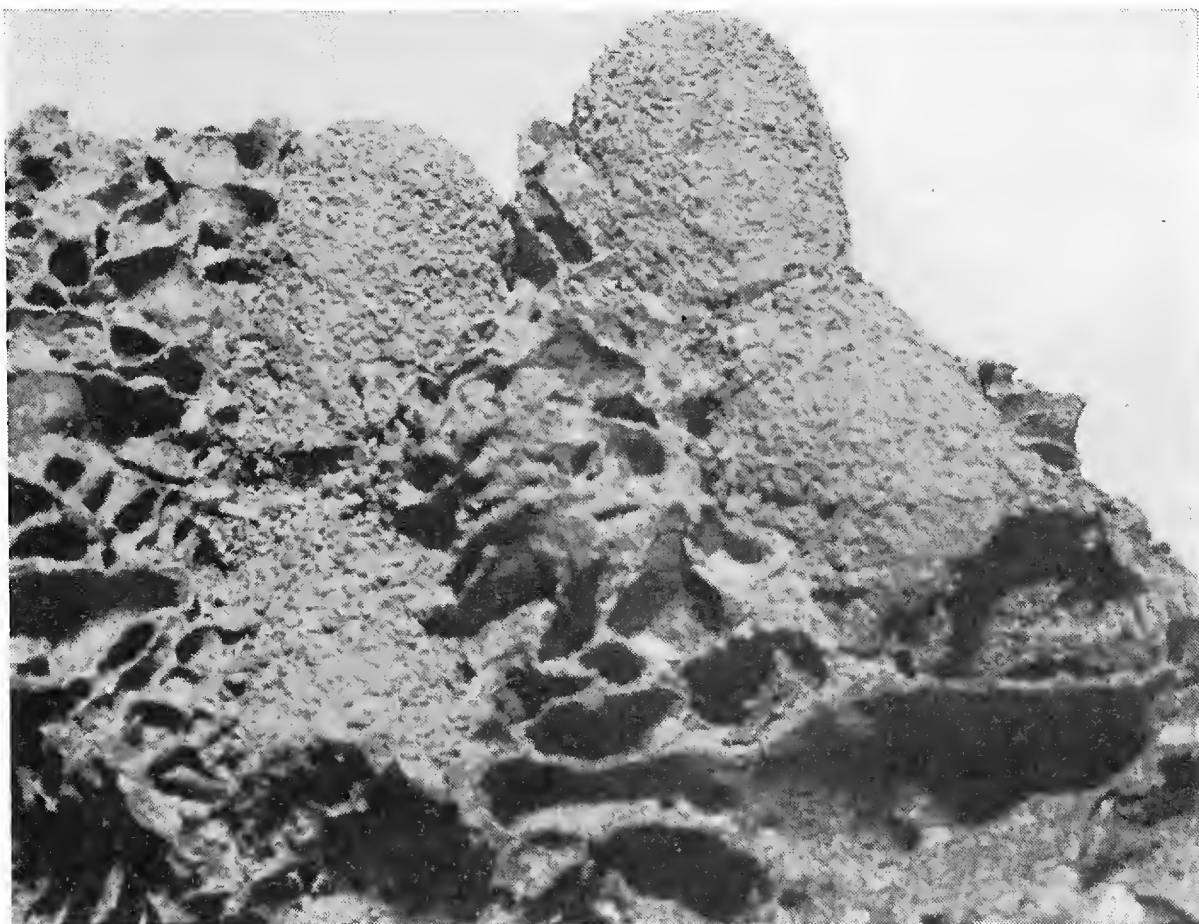
Table 1. Summary of termite nests examined for stages of *Centris derasa*, September 1962 through May 1963.

Month	No. of Nests Examined	No. of Nests with Cells	Total Cells	Largest No. of Cells in One Nest	Living Stages
1962 September	48	21	124	12	—
October	40	25	174	48	1 larva
November	138	86	1,101	150	1 larva
December	86	56	432	34	1 dead adult 3 provisioned cells
1963 January	71	25	588	34	—
February	117	53	303	16	1 dead adult 4 provisioned cells 1 live adult
March	82	31	166	26	1 dead adult
April	94	28	145	22	—
May	54	13	64	16	4 provisioned cells

of the nests was disappointingly small, and attempts to rear adults from these were unsuccessful. It is believed that many of the cells after being provisioned and sealed off were invaded by the termites, resulting in the death of the developing bee.

As the cells are found in sections of the nests in which the termites are active, it is apparent that the female bee tunnels into the nest in the presence of the termites, often to a depth of 4 to 6 inches. Because of termite activities, the bee obviously must work quickly to construct, provision, and seal each cell before it is invaded by the termites. From two to five cells lying end to end are present in each series of cells. In a few nests a second tunnel branching from the same entrance hole has been found, but in most nests the position of the different series would indicate the construction of a separate entrance hole for each.

The cells are elongate (length 22–24 mm) circular in cross section, broadest near the lower end (diameter 15 mm) and tapering gradually to the upper end (diameter 11 mm). The upper end is closed with a flat cap, whereas the lower end may be flattened or rounded externally but is always rounded internally. Each cell consists of an outer layer presumably constructed mainly of mud obtained from the termite nest and a smooth, dark inner layer approximately 0.2 mm in thickness apparently constructed of a mixture of mud and wax. This layer is impermeable to water. The full-grown larva prior to pupation lines the cell with a thin,



EXPLANATION OF FIGURE

Fig. 1. Section of nest of *Microcerotermes arboreus* containing four cells of *Centris derasa*.

golden, papery cocoon. A section of the nest with four cells is shown in Fig. 1.

Although attempts to rear adults from larvae obtained from cells were unsuccessful, one partially grown larva removed with the pollen mass from the same cell and placed in a paper-lined glass vial of slightly larger diameter than the cell completed its feeding, lined the vial with the golden papery cocoon, and pupated but died in the late pupal stage. Two full-grown larvae pupated in similar containers but also failed to attain the imago stage.

No published records of other nesting sites of *Centris derasa* have been noted nor have there been any records of other species of the genus inhabiting termite nests. It cannot be definitely stated, therefore, that *Centris derasa* does not at times also construct cells in the soil as do many other species of the genus, but evidence to date indicates that nests of *Microcerotermes arboreus* Emerson are the only sites utilized.

The evolution of the peculiar habit of utilizing termite nests can only be surmised. As many species of *Centris* do nest in the ground, certain species at a depth of several feet in compact soil, little adaption is needed

for the construction of tunnels in nests of those species of termites which are constructed of earth or mud apart from the ability to work in the presence of termites and to construct, provision, and seal cells which are resistant to termite attack. As *M. arboreus* at times constructs nests at ground level, it is conceivable that in an earlier evolutionary period during a series of very wet years when the ground was too waterlogged for the construction of nests in the soil the bees started to utilize abandoned termite nests near ground level. From this it would then be a short step to the utilization of occupied nests several feet above the ground, particularly as tunnels are constructed quite rapidly, probably in the space of one day, and in the event of partial blockage by the termites during the night they could very quickly be reopened the following day. Similarly, once a cell has been constructed it is probably provisioned and sealed during the same day.

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- ADAMSON, A. M. 1937. Preliminary report on termites and termite damage in Trinidad, West Indies. *Trop. Agric.*, 14: 141-149.
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Trichoptera of Baja California

D. G. DENNING

Moraga, California

Several collections of Trichoptera from Baja California have recently been made by members of the California Academy of Sciences and the University of California. These collections have largely been responsible for almost doubling the known trichopterous fauna of Baja California. Of particular interest are three new species which are herein described.

To date the majority of Trichoptera from Baja California are also known from the western United States and western Mexico. Future collecting should determine if the new species are endemic species; it is probable that only *Atopsyche hintoni*, n. sp., is confined to the peninsula.

In January 1959, H. B. Leech, California Academy of Sciences, collected one larva and several pupae of a rhyacophilid in a stream near Miraflores, Baja California. The stream is subject to rapid torrents following tropical storms and is considerably scarred. The stream bed contains large boulders and at the time of collecting contained deep pools of water. Mr. Leech states, "I collected chiefly in various shallow pools with sandy shores and bottoms, and in the stream joining them." A mature male was dissected from one pupal case and the new *Atopsyche* described herein is based on that male.

In 1950, H. E. Hinton described the chelate front leg of an undetermined Bolivian *Atopsyche* larva. Of interest to insect morphologists and taxonomists is that, as Hinton discussed, chelate legs are not known from any other trichopteran, nor "in any other endopterygote larvae except in a dytiscid, *Matus bicarinatus* Say. . . ." The significance of Leech's collection is that a definite association of larva, pupa, and adult to a described atopsychid is now possible.

***Atopsyche hintoni* Denning, new species**

(Figs. 1-2)

This is the first *Atopsyche* to be described from Baja California. On the basis of the constricted apical segment of the clasper and the paracercus with two prominent dorsal spines, it is related to *boneti* Ross and King. The paracercus with its distinctive spines and the aedeagus with the ventral lobes will distinguish this species. One mature larva and 4 pupae were collected together. The identity of the larva was established by means of the male metamorphotype.

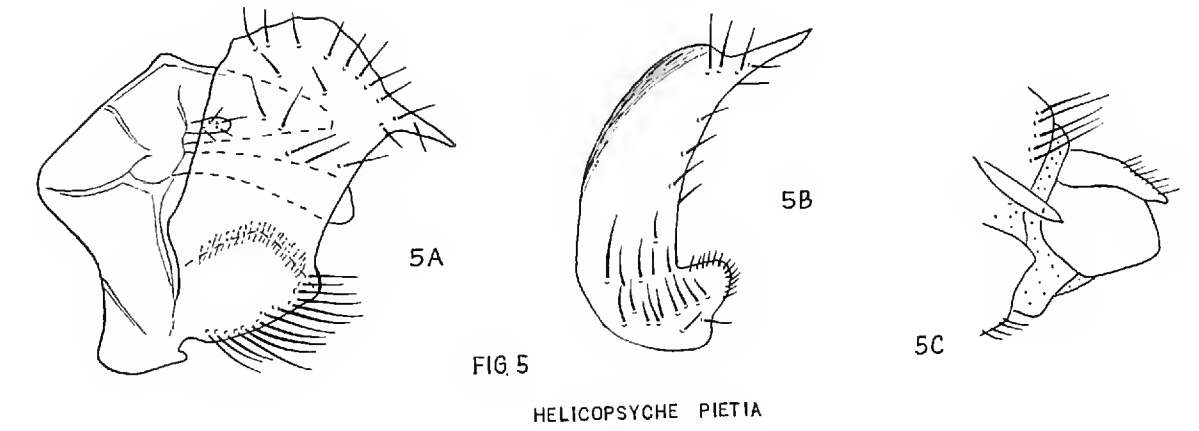
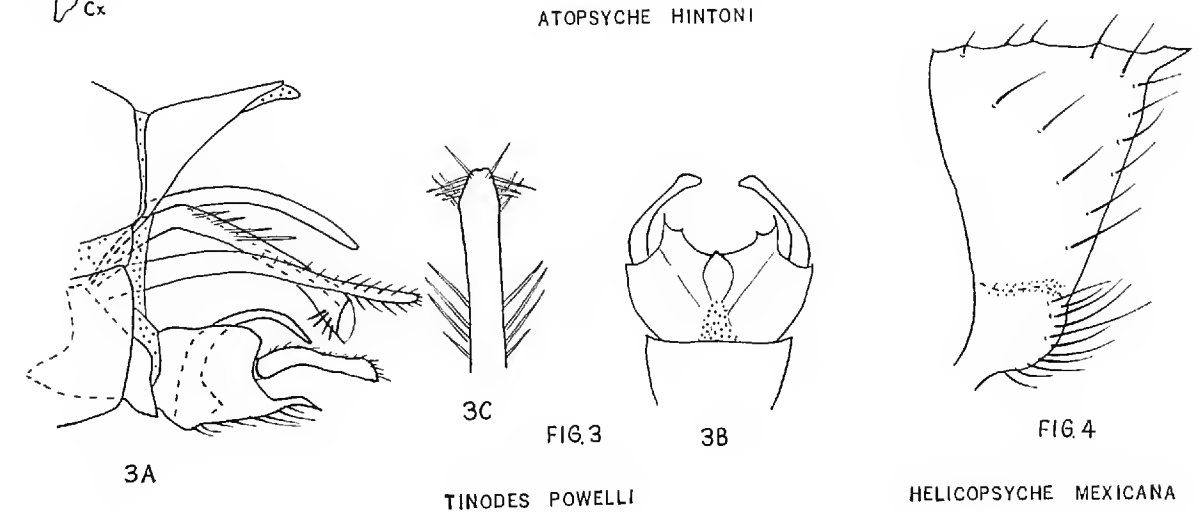
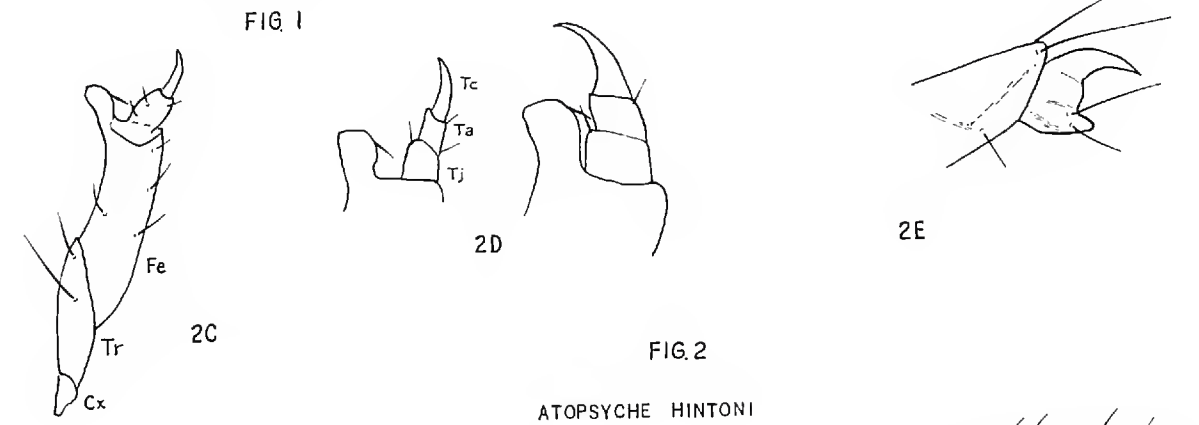
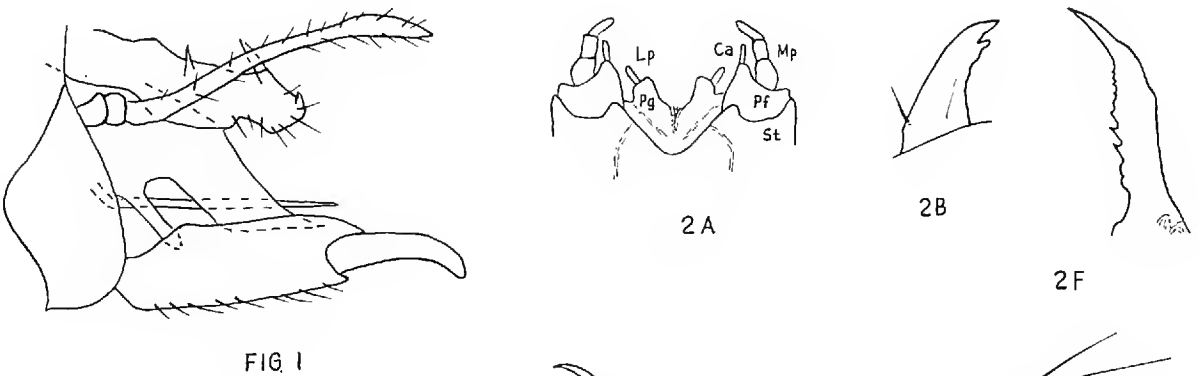
LARVA.—Length 13 mm, width 1.5 mm. Head fuscus. Frontoclypeus sutures well marked, slightly depressed. Eyes scarcely discernible, antennae atrophied. Four pairs of setae arise from genae, none from frontoclypeus. Two pairs of minute setae arise from labrum near anterior margin. Maxillary palpi with third segment conical and longer than first two; labial palpi single segmented, small (Fig. 2A). Mandible (Fig. 2B) with prominent mesal tooth.

Pronotum yellowish, lateral margins dark, posterior margin black; mesonota and metanota light yellowish color. Legs uniformly yellowish except for the anterior dark stripe of the large coxae. First pair of legs chelate, ventral corner of femur (Fig. 2C), produced into a prominent thumb-like process bearing a rather stout dorsal seta directly mesad; tibia and tarsus greatly reduced, the hinged tibia permitting it and the tarsus to fit closely along edge of the chelated femur (Fig. 2D). Accordingly, a very efficient grasping organ for the predacious larva has been developed in the genus. Anal claspers or hooks (Fig. 2E) short, apically acute, no auxiliary hooks; sclerotized shield present on ninth tergum. External gills absent.

PUPA.—Length 7 mm. Ellipsoid pupae brownish, in appearance very similar to a dipteran puparium. Mandible long, sickle-shaped, mesal margin serrate, apex acute (Fig. 2F). Labrum subtriangular. Mature male removed from pupa and described as a new species.

ADULT.—Sternites 6 and 7 bearing a prominent mesal spine. Genitalia as in Fig. 1. Tenth tergite consists of a large semimembranous lobe directed dorsocaudad, seen from dorsal aspect basal portion flared laterad. Paracercus bearing a strong dorsal spine near apex and a smaller spine near center; apex obtuse, setiferous, bearing an apical dorsad-directed hook. Filicercus filiform, apically clavate, setiferous entire length. Clasper with basal segment practically same width throughout, apical segment slightly constricted, curved ventrad. Aedeagus somewhat slipper-shaped from lateral aspect (Fig. 1), ventral margin produced into a slender, long lobe near base, apical lobe produced caudad and slightly dorsad; seen from ventral aspect only the strong mesal edge discernible, the dorsal portion flared slightly laterad between the paracerci; inner rod plainly visible from ventral or lateral aspect.

Holotype mature male pupa: MIRAFLORES, BAJA CALIFORNIA, 19 January 1959, H. B. Leech. Collected in a stream in ARROYO SAN BERNADINO, about 3 MILES NORTHWEST OF MIRAFLORES, the stream is a tributary to Arroyo San Jose. Paratypes, one mature larva, three immature pupae. Types deposited in California Academy of Sciences, San Francisco, California.



It is with pleasure that I name this new species in honor of Dr. H. E. Hinton. While at the University of Bristol, Dr. Hinton described the first known chelate front leg of a Trichoptera. Hinton's study of the musculature of the greatly developed femur and trochanter, and the greatly reduced tibia and tarsus revealed very little modification from a nonchelate leg.

***Tinodes powelli* Denning, new species**

(Fig. 3)

This species is related to *consueta* McL. and may be distinguished from it by the long apical segment of the clasper, by the mesal portion of the basal segment of the clasper which is produced into three acute apices rather than two, by the unarmed lobe of the aedeagus, and several other differences.

MALE.—Length 8–9 mm. Wings, body, appendages light brown, palpi similar in color, glabrous. Front tibia with no preapical spur, spurs brownish and glabrous. Genitalia as in Fig. 3. Ninth tergum produced caudodorsad as an elongate triangular lobe, apex fringed with a membranous sheath; ninth sternite largely withdrawn into eighth, only a narrow subtriangular portion exposed. Cerci elongate, fusiform, extending caudad beyond any portion of genitalia, setae minute and sparse. Basal segment of clasper quadrate, ventral corner produced caudad as an acuminate point when viewed laterally (Fig. 3A); from ventral aspect (Fig. 3B), ventral lobe is divided into two acute apices and the mesal lobe into one acute apex; apical segment narrow, somewhat sinuate, apex subacute from lateral aspect. Mesal blade of clasper curved ventrad, acuminate, in about half the males examined a short acute dorsad-curved spine arises from the left basal portion. Aedeagus lobe (the tenth tergite?) single, unarmed; the lobe is normally placed within a dorsal groove of the aedeagus. Aedeagus (Fig. 3C) armed with prominent basal and apical spines.

FEMALE.—Length 10–11 mm. General structure and coloration similar to male except for usual antigenetic differences. Apical segments of abdomen characteristically elongate and conical. Eighth tergite large, occupying a major portion of segment. Tenth tergite consists of a pair of elongate obtuse plates bearing the usual pair of minute setae distally.

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EXPLANATION OF FIGURES

Fig. 1. *Atopsyche hintoni*, male genitalia, lateral aspect. Fig. 2. *Atopsyche hintoni*, larva, pupa; 2A, maxillo-labrium, ventral aspect; st, stipes; pf, palpifer; mp, maxillary palp; ga, galea; pg, palpiger; lp, labial palp; 2B, right, larval mandible; 2C, larval foreleg; cx, coxa; tr, trochanter; fe, femur; ti, tibia; ta, tarsus; tc, tarsal claw; 2D, larval chelate-claws, enlarged; 2E, right, larval anal hook; 2F, right, pupal mandible. Fig. 3. *Tinodes powelli*, male genitalia; 3A, lateral aspect; 3B, claspers, ventral aspect; 3C, aedeagus, dorsal aspect. Fig. 4. *Helicopsyche mexicana* Banks, clasper, lateral aspect. Fig. 5. *Helicopsyche pietia*, 5A, male genitalia, lateral aspect; 5B, clasper, lateral aspect; 5C, female genitalia, lateral aspect.

Holotype male: SIERRA SAN PEDRO MARTIR, 6,500 feet, LA GRULLA, BAJA CALIFORNIA, MEXICO, 28 May 1958, J. A. Powell. Allotype female, same data as for holotype. Paratypes, 5 males, 1 female, same data as for holotype; 2 males, 2 females, Arroyo Santo Domingo, 5.8 miles from Hamilton Ranch, Baja California, Mexico, 22 April 1963, P. H. Arnaud and H. B. Leech. Paratypes deposited in California Academy of Sciences, San Francisco, California. Holotype and allotype are in the author's collection.

I take pleasure in naming this new *Tinodes* in honor of the collector, Dr. J. A. Powell, California Insect Survey, University of California, Berkeley.

***Helicopsyche pietia* Denning, new species**

(Fig. 5)

This species appears to be related to *mexicana* Banks, and may be distinguished from that species by the acute lateral projection arising from the clasper; in *mexicana* the apical corner is produced into a sharp point (Fig. 4).

MALE.—Length 8–9 mm. Head, body, and appendages light tan color, wings uniformly tan. Sixth sternite bearing a yellowish mesal spur, almost as long as sternite, third and fourth sternites reticulated. Genitalia as in Fig. 5. Ninth sternite narrowed to about half the width of the mesal portion; ninth tergite narrowed and merged into the tenth tergite. Cerci narrow, small, and inconspicuous. Tenth tergite long, narrowed distally, a dorsolateral sclerotized ridge extends entire length. Claspers large, dorsal margin broadly arcuate, caudal margin produced ventrocaudad as a prominent attenuated point (Fig. 5A); ventral margin bearing a dense brush of long, yellowish setae; mesal portion at base cushion-like, bearing dense, short, brownish spines best viewed from laterocaudal view (Fig. 5B); seen from ventrocaudal aspect mesal cushion stalked. Aedeagus slightly curved, cylindrical, apex with mesal incision and extending slightly beyond clasper.

FEMALE.—Length 9–10 mm. Similar to male in general appearance but more robust and slightly darker brown. Fifth, sixth, and seventh sternites reticulated. Sixth and seventh sternites bear a dense row of dark yellow setae. Seventh sternite bearing a small, dark yellow mesal spur. Genitalia typical for genus, as in Fig. 5C.

Holotype male: 3 MILES SOUTHWEST OF MISSION SAN JAVIER SOUTHWEST OF LORETO, BAJA CALIFORNIA, MEXICO; 14 December 1958, H. B. Leech. Allotype female, same data as for holotype. Paratypes, 3 males, 9 females, same data as for holotype. All types in California Academy of Sciences except 2 male and 2 female paratypes in the author's collection.

This is the fifth helicopsychid species described from the U. S. and Mexico. All species but *H. limnella* Ross have been recorded from Mexico.

The key to the males of *Helicopsyche* in the Nearctic by Ross (1944) can be revised to accommodate this new species, as follows:

- 1. Claspers with apical corner or apicocaudal margin produced into an acute, triangular point 2
Claspers with apical corner rounded 4
- 2. Mesal process at base of claspers cushion-like, sclerotized mesal projection of sixth sternite yellowish and about half the length of the sternite *mexicana* Banks
Mesal process at base of clasper stalked, sclerotized mesal projection of sixth sternite yellowish or black 3
- 3. Mesal process of sixth sternite black, as long or longer than sternite *limnella* Ross
Mesal process of sixth sternite yellow, not as long as sixth sternite .. *pietia*, n. sp.
- 4. Claspers angled and shaped like a boomerang *piroa* Ross
Claspers only slightly curved, broad, and spatulate *borealis* Hagen

In 1951 Ross recorded 14 species of Trichoptera from Baja California. Additional records that are now available and listed herein increase the known species to 26. In addition to the three new species described here, only three species are as yet known only from Baja California: *Chimarra laguna* Ross, *Polycentropus bartolus* Denning, and *Lepidostoma rhino* Ross.

RHYACOPHILIDAE

- 1. *Rhyacophila rayneri* Ross California and Baja California
- 2. *Atopsyche hintoni*, n. sp. Baja California

PHILOPOTAMIDAE

- 3. *Chimarra angustipennis* Banks Southwestern United States, western Mexico, and Baja California
- 4. *Chimarra barranca* Denning Baja California, western Mexico, and Texas
- 5. *Chimarra elia* Ross Southwestern United States, Baja California
- 6. *Chimarra laguna* Ross Baja California
- 7. *Chimarra utahensis* Ross Western United States and Baja California

PSYCHOMIIDAE

- 8. *Polycentropus bartolus* Denning Baja California
- 9. *Tinodes powelli*, n. sp. Baja California

HYDROPSYCHIIDAE

- 10. *Hydropsyche occidentalis* Banks Western United States and Baja California
- 11. *Hydropsyche oslari* Banks Western United States and Baja California
- 12. *Hydropsyche philo* Ross California and Baja California
- 13. *Cheumatopsyche micileli* Denning California, Baja California, and Sonora
- 14. *Smicridia* sp. Baja California

LIMNEPHILIDAE

15. *Limnephilus frijole* Ross Southwestern United States and Baja California

ODONTOCERIDAE

16. *Marilia flexuosa* Ulmer Texas, Brazil, Arizona, and Baja California
 17. *Marilia nobbsa* Milne Texas and Baja California

CALAMOCERATIDAE

18. *Notiomyia sagittosa* Ross Baja California and Sonora

LEPTOCERIDAE

19. *Oecetis disjuncta* (Banks) Western United States and Baja California
 20. *Oecetis inconspicua* (Walker) North America including Baja California
 21. *Leptocella* sp. Baja California
 22. *Mystacides alafimbriata* Griffin Western United States and Baja California

LEPIDOSTOMATIDAE

23. *Lepidostoma rhino* Ross Baja California

SERICOSTOMATIDAE

24. *Sericostoma griseolum* McLachlan California and Baja California

HELICOPSYCHIDAE

25. *Helicopsyche borealis* (Hagen) North America including Baja California
 26. *Helicopsyche pietia*, n. sp. Baja California

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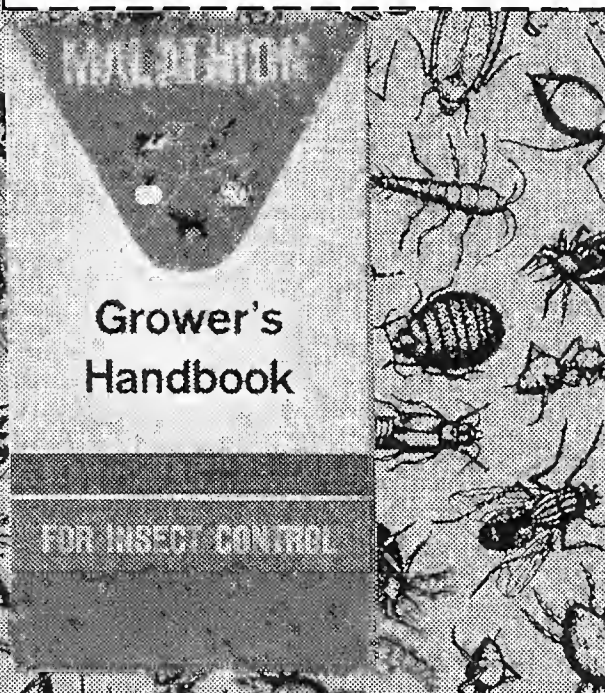
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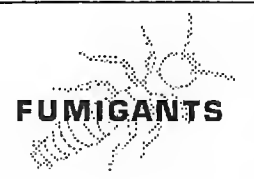
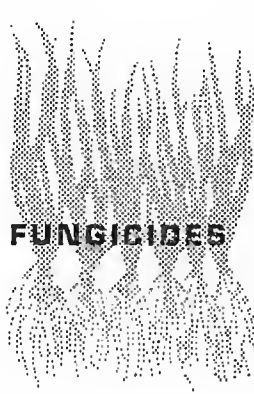
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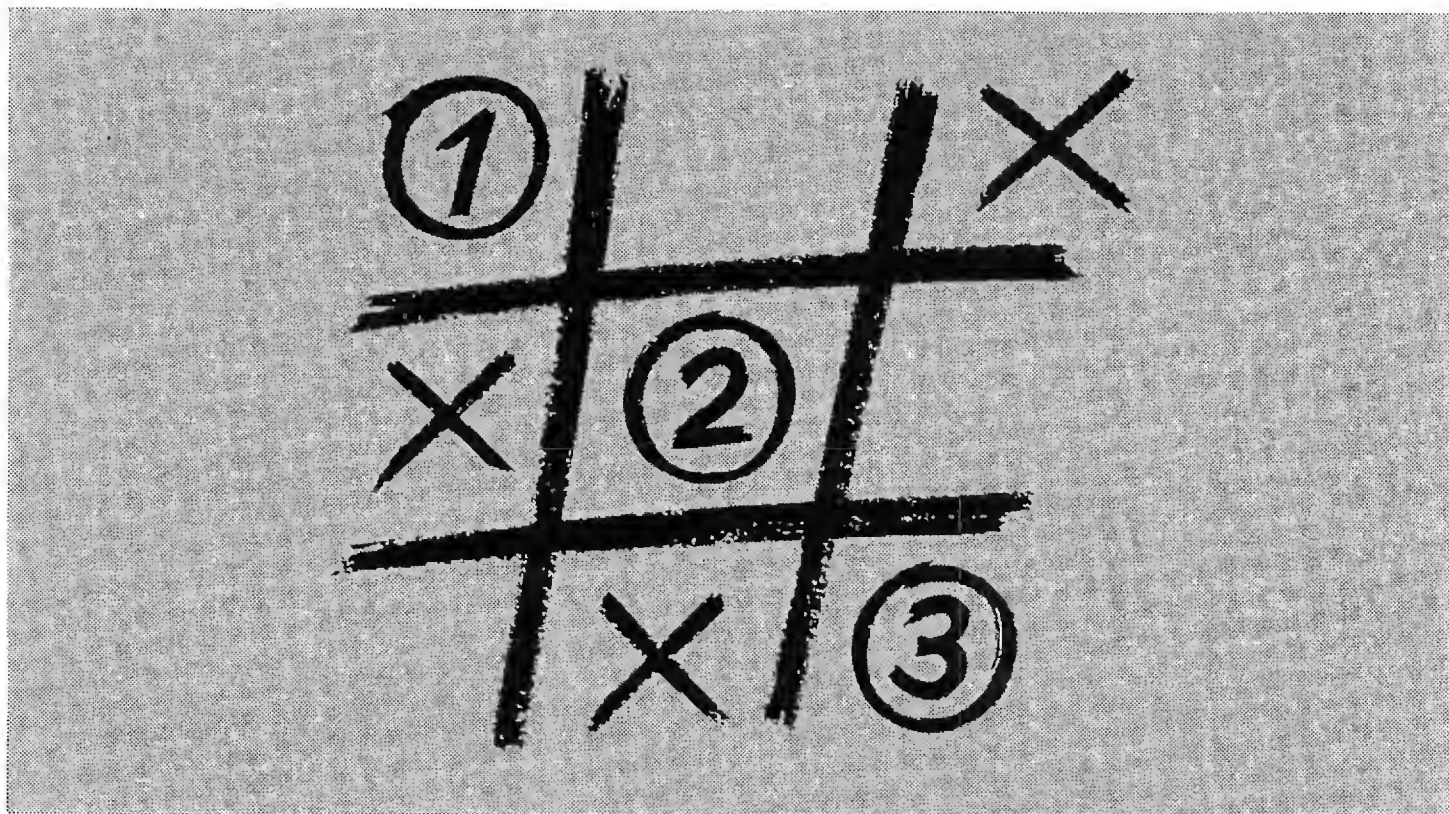
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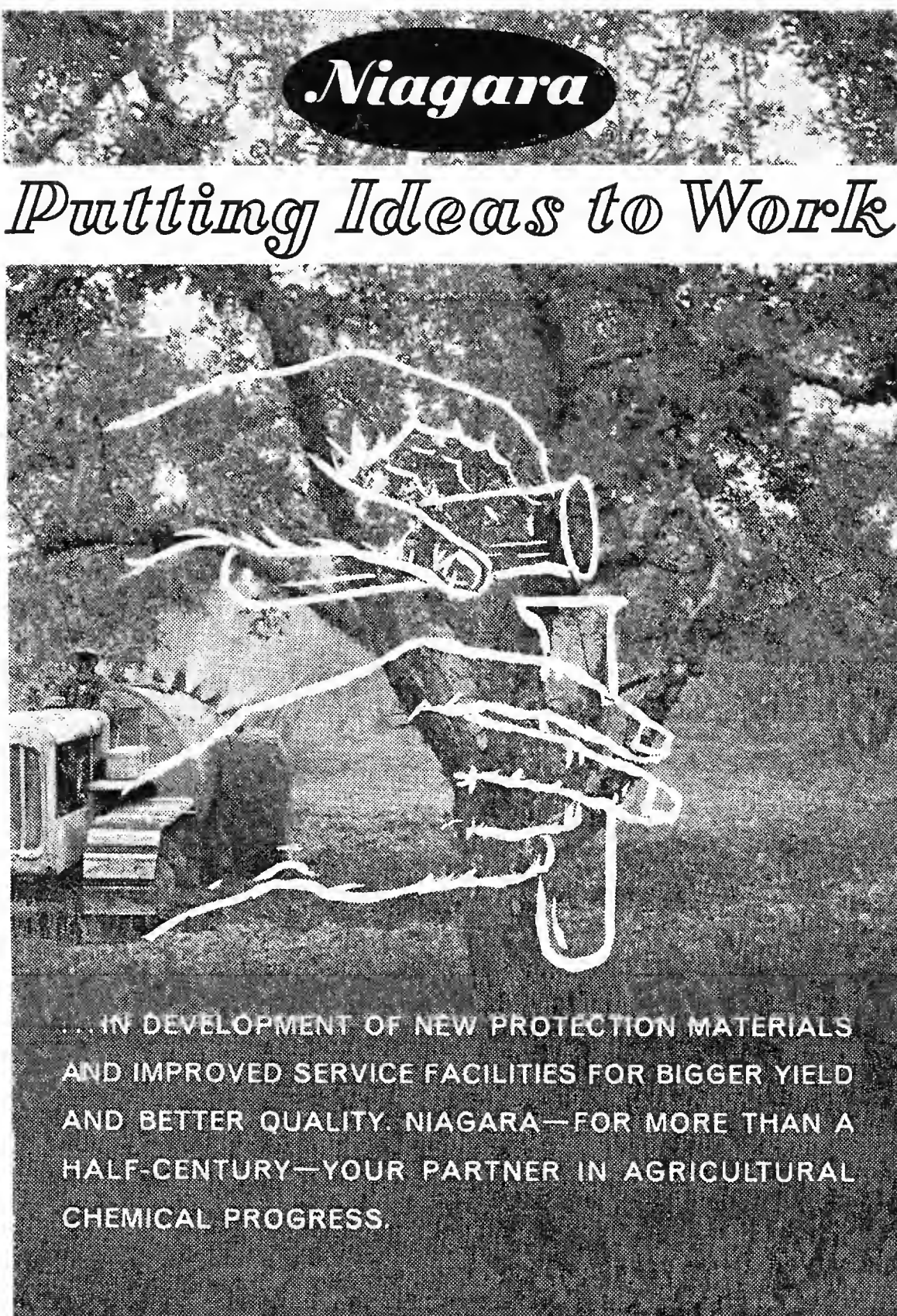
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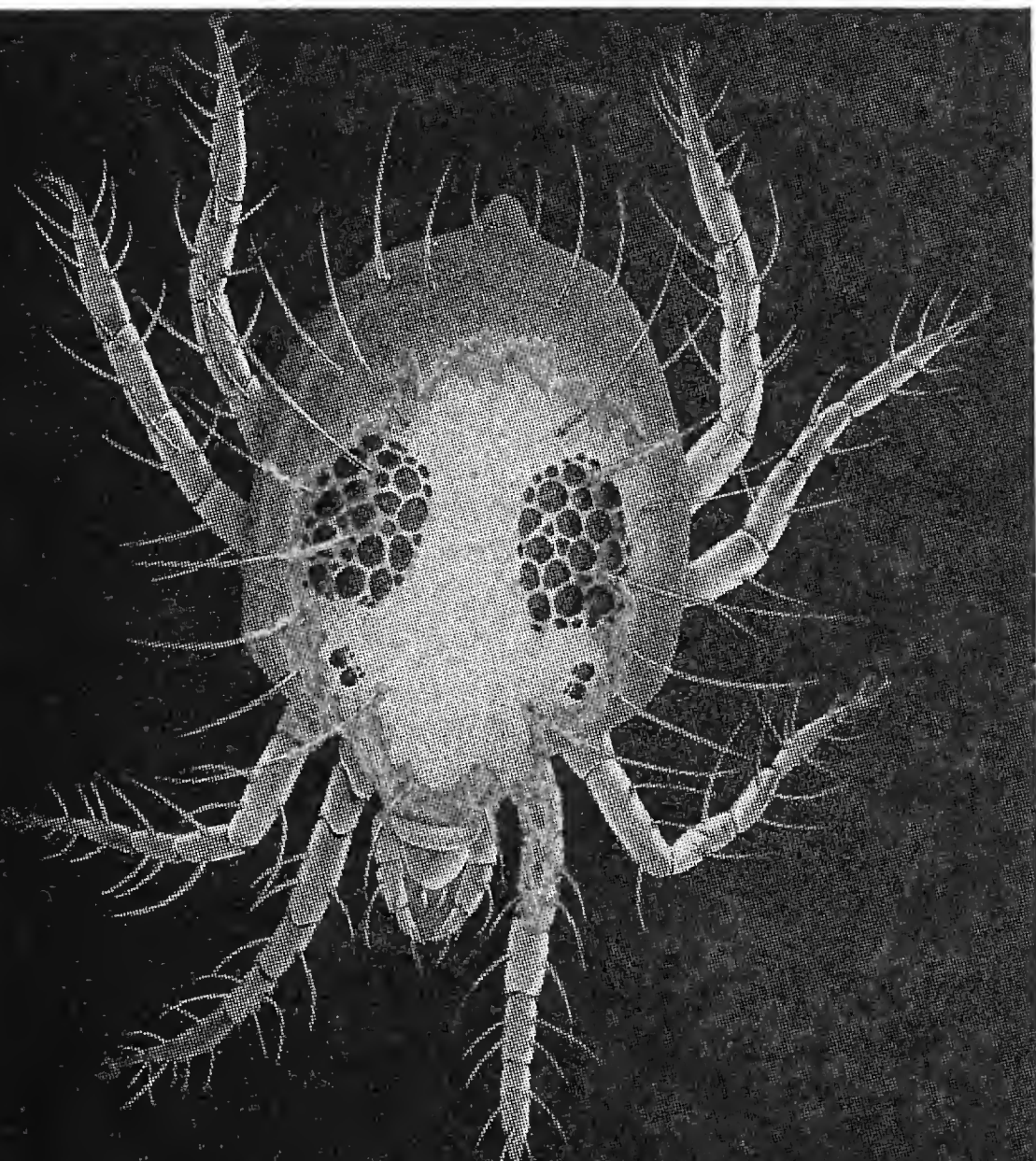
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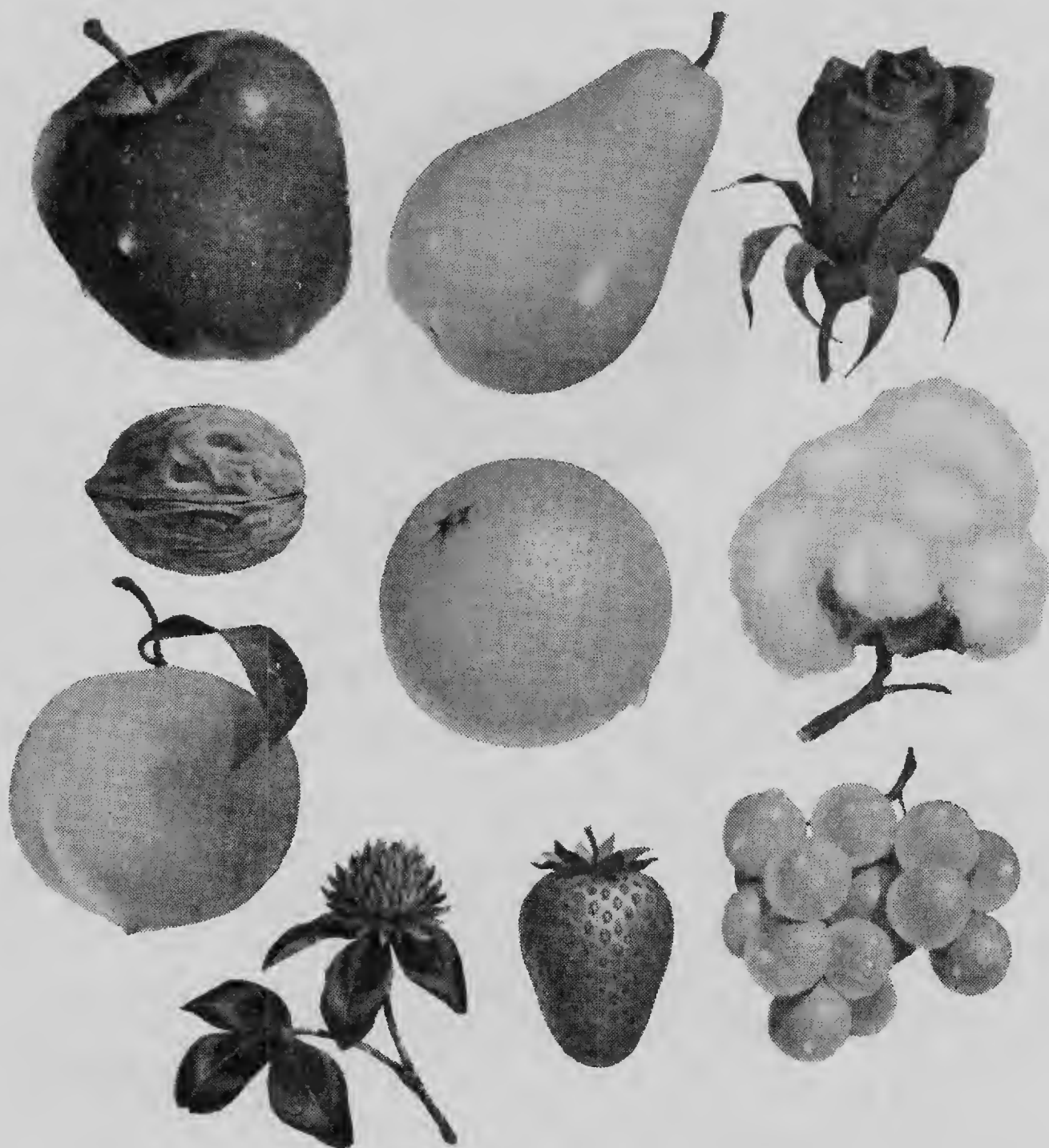
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Title of Publication: The Pan-Pacific Entomologist

Frequency of Issue: Quarterly (January, April, July, October)

Location of Office of Publication, Business Office of Publisher, Publisher and Owner: Pacific Coast Entomological Society, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118.

Editor: Dr. Howell V. Daly, 112 Agriculture Hall, University of California, Berkeley, California 94720.

Managing Editor and Known Bondholders or other Security Holders: none.

This issue mailed 2 September 1964

Second Class Postage Paid at Lawrence, Kansas, U.S.A.

THE ALLEN PRESS PRINTED IN U.S.A. LAWRENCE, KANSAS

The Pan-Pacific Entomologist

Vol. 40

JULY 1964

No. 3

The Biology of *Aphrophora permutata* and Some Observations on *Aphrophora canadensis* Attacking Monterey Pine in California¹

(Homoptera : Cercopidae)

WALTER E. KELSON²

Mt. Diablo High School, Concord, California

Monterey pine (*Pinus radiata* D. Don) is native to three coastal areas in California and has been extensively planted as an ornamental throughout the coastal plains and mountains. Because of its rapid growth rate and favorable mechanical properties, it has assumed considerable importance as a timber tree in some countries and may become so in this country (Schaefer, 1962). An increased knowledge of the possible insect enemies of Monterey pine is therefore desirable. At least two *Aphrophora* species are found on this tree in sufficient numbers to cause damage.

Although *A. permutata* appears to be the most abundant *Aphrophora* in the United States (Doering, 1941), the life history has not been completely studied. Severin (1950) did not find the egg stage, and it will be shown that he also confused the nymphs of *A. canadensis* Walley with those of *A. permutata* and thought that *A. canadensis* was a second generation of *A. permutata*.

The present investigation was initiated in July 1961 (Project 1777, "The classification, bionomics, ecology and control of insect pests of forest regeneration in California"). The primary objective of this study has been to study the biology of *A. permutata* on *Pinus radiata* D. Don, but observations on the biology of the related *A. canadensis* Walley were unavoidable.

The main study areas were in the regional parks of the Oakland and Berkeley hills in Contra Costa and Alameda Counties, California at elevations ranging from 1,000 to 1,500 feet. In this area Monterey pine trees have been planted in reforestation projects and as ornamentals. Many of the weeds described as hosts of *A. permutata* (DeLong and Severin, 1950) are found in the immediate vicinity of the trees in this area. The biologies of the two insects were also followed in Monterey, California and *A. permutata* was also studied in the Pleasant Hill area (Contra Costa County) where semiarid conditions prevail during the late spring and summer. Col-

¹ M.S. thesis, University of California, January 1964. Supported by the National Science Foundation's High School Teachers Research Program and the T. B. Walker and Surdna Foundations.

² Chairman, Science Department, Mt. Diablo High School, Concord, California.

lections of adults and nymphs of both species were made in other bay area locations.

MATERIALS AND METHODS

Both species were observed under natural field conditions and in cages in the laboratory and field to determine feeding and mating habits and oviposition. Nymphs were followed in the field and raised in the laboratory to determine nymphal instars, their duration, and host preference. Rearing was successful on cuttings of the last two whorls of Monterey pine terminals kept fresh by being placed in water-filled vials. Nymphs of *A. permutata* were reared on potted plants of the imported weed, bristly oxtongue (*Picris echioides* L.). Segregation of instars was accomplished by head capsule measurements, a method found successful by Anderson (1947) with the Saratoga spittlebug. Development of wing pads and color changes were also used to differentiate the fourth and fifth instars.

DISTRIBUTION, HOST RECORDS, AND TAXONOMY

Aphrophora permutata Uhler is the commonest *Aphrophora* in the United States as far as the number of specimens collected is concerned (Doering, 1941). It has been collected in Colorado, California, Idaho, Montana, New Mexico, Oregon, Utah, and Washington in the United States and Vancouver Island in Canada.

Doering (1942), in her summary of host plant records of Cercopidae, lists *Chrysopsis villosa* (Pursh), *Lupinus* sp., *Pinus* sp. (adults), and *Sambucus callicarpus*. Doering (1941) states that *C. villosa* and *Lupinus* sp. are found commonly over a wide territory but *Aphrophora* nymphs have never been found on them except where they are in the vicinity of pine trees. Essig (1926) reports finding *A. permutata* nymphs on rhubarb, dock, dandelions, poppies, lettuce, and many other plants. Severin (1950) reports that it feeds on some 16 plant families, both herbaceous and woody. I found bristly oxtongue, *Picris echioides* Linn., growing in the vicinity of pine trees to be the commonest host of the nymphs while the eggs and adults were found on Monterey pine.

Aphrophora canadensis Walley has previously been collected in British Columbia, Canada and Monterey and Siskiyou National Forest, California. The insect was found to be very common in the Monterey and San Francisco Bay areas during this study, seemingly only in areas of frequent spring and summer fog.

Apparently there is no information on the biology of this insect although the adults have been described (Walley, 1928). The nymph and adult stages of this insect were collected on *Pinus* species. They were very abundant on Monterey pine.

The taxonomic status of the genus *Aphrophora* has been extensively

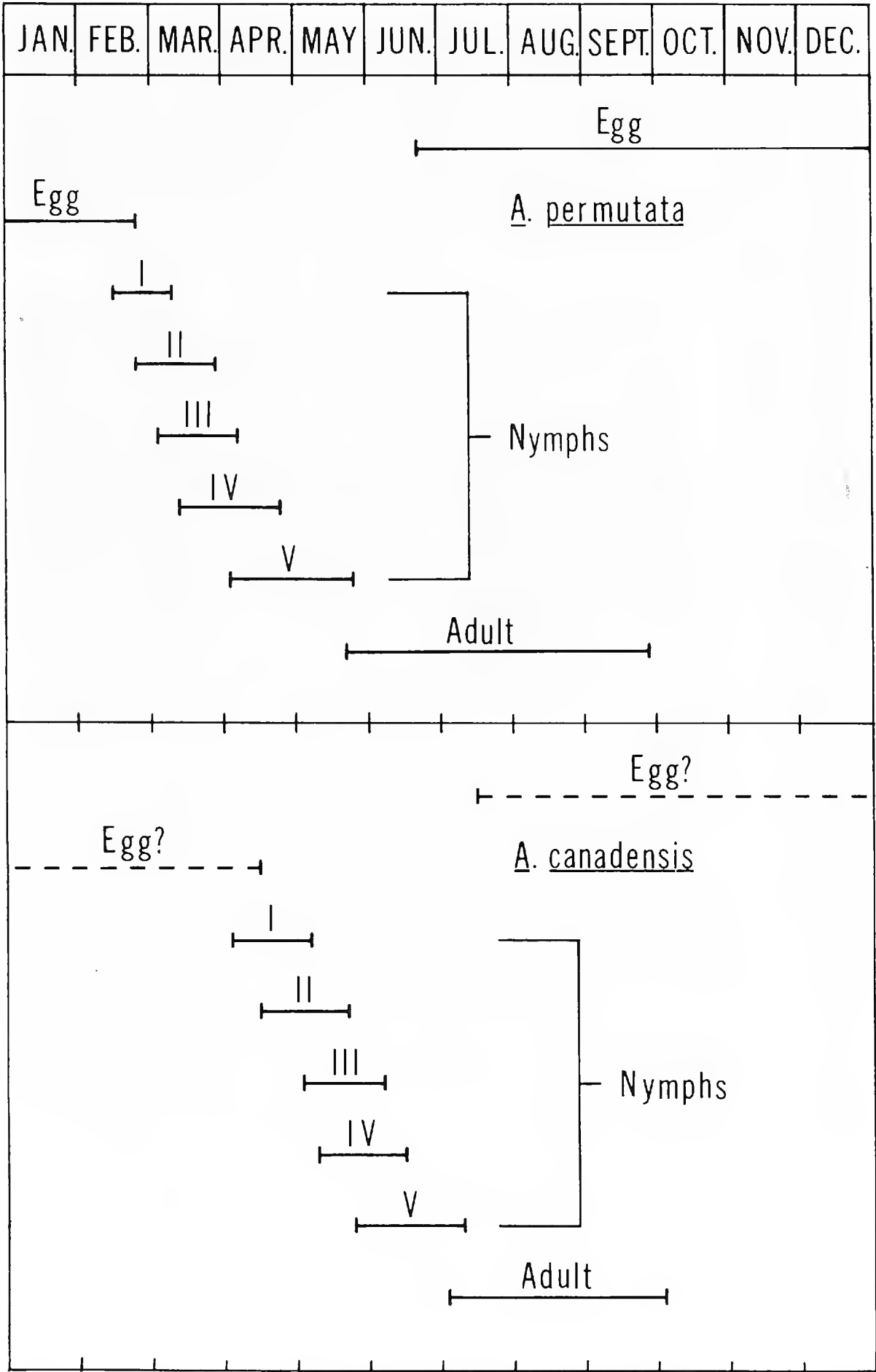
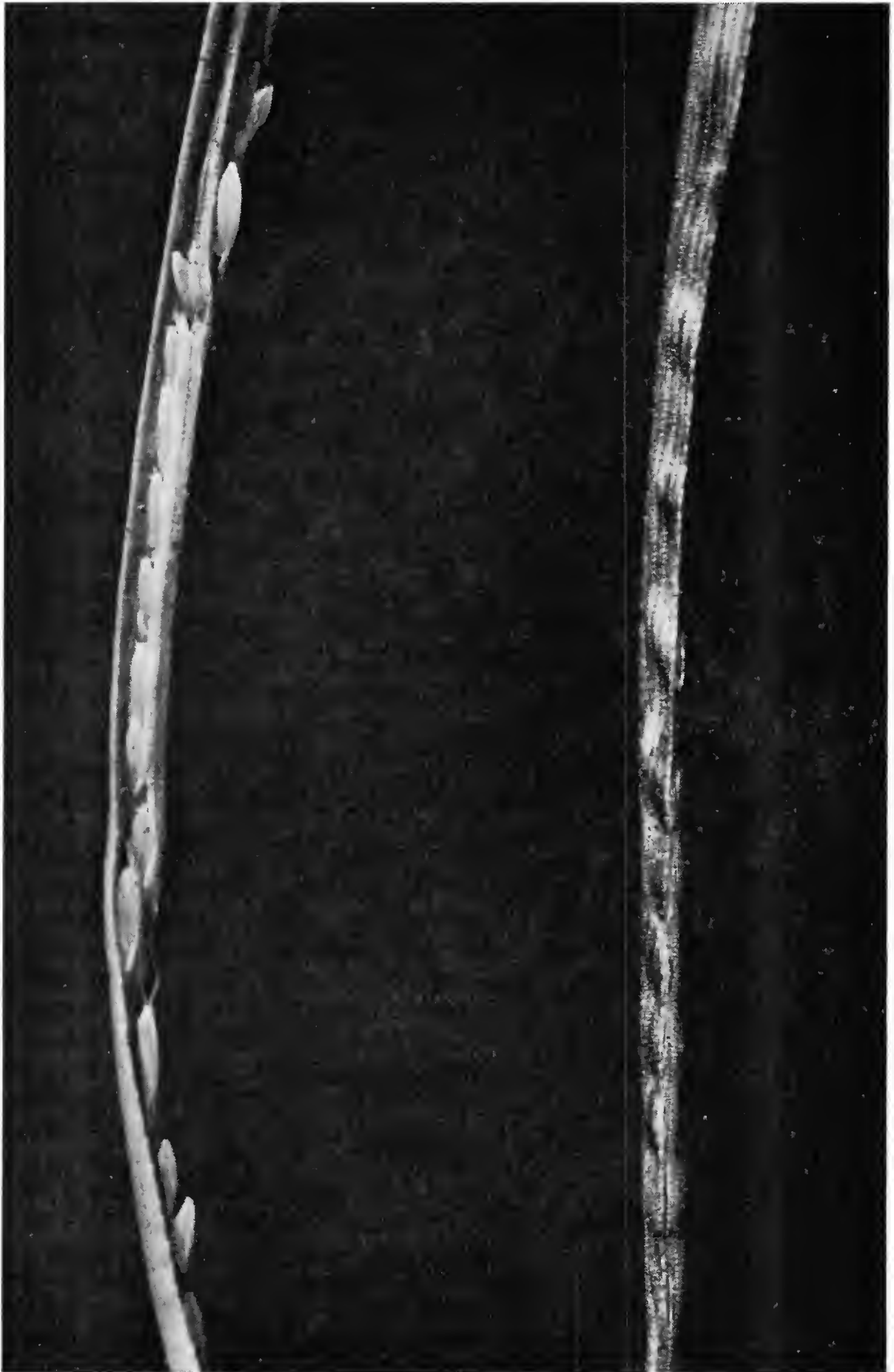


Fig. 1 Schematic representation of the life cycles of *Aphrophora permutata* Uhler and *Aphrophora canadensis* Walley in the San Francisco Bay area (1962-1963).



EXPLANATION OF FIGURE

Fig. 2. Eggs of *A. permutata* showing location and degree of insertion in Monterey pine needles.

treated by Doering (1941). *A. permutata* was originally described by Uhler in 1876 from specimens collected in Colorado, Utah, and California. *A. canadensis* was described by Walley in 1928. Ball (1934) considered this species to be synonymous with *A. saratogensis* Fitch but Doering (1941) confirmed the validity of *A. canadensis*. The male genital plates have proven to be an effective means of distinguishing various species of this genus (Ball, 1898; Doering, 1941). The adults of both species studied, *A. permutata* and *A. canadensis*, were determined by Doering in September 1961.

BIOLOGY OF APHROPHORA PERMUTATA UHLER

Although Severin (1950) reported two generations of *A. permutata*, the nymphs of the first occurring on native weeds and the nymphs of the second on Monterey pine, I found only one generation annually (Fig. 1). The eggs are deposited in June and July on pine needles and the insect overwinters in this stage. Eclosion begins in February. The first instar nymphs drop to the ground and the entire nymphal period is spent on weeds adjacent to pine trees. The adults begin to emerge from the spittle mass in May and fly to the pine trees where copulation and oviposition take place. Adults are found from May to late September.

The egg is small, oblong, one end being rather pointed with the long axis slightly curved. The surface has a stippled texture. The color immediately after laying is a pale yellow, turning to a dark purple as the egg matures. The average length and width of 75 eggs was 1.7 mm and 0.5 mm, respectively. The egg is deposited in a niche cut in the pine needle with the dorsal surface of the egg toward the slit. The depth of insertion varies from complete to just the tip of the egg holding it to the needle (Fig. 2). The number of eggs deposited per needle varies from two or three to 27; however, one needle was found containing 40 eggs.

There are five nymphal instars; instars were determined by measurement of the clypeus between the antennae (Anderson, 1947). Body lengths and head capsule measurements were made on preserved specimens (Table 1). The colors described are for living nymphs.

The distinctive character of the first four instars is a sharp color division between the dark brown head and thorax and the bright pink abdomen. This color difference appears to be characteristic of *Aphrophora*. It was found in *A. canadensis* during this study, *A. saratogensis* (Eaton, 1955), and others (Osborn, 1916). Osborn (1916) found the brown and pink colors only in the fourth instar of *A. parallela*; the color difference in the first three instars was a polished black for head and thorax and yellow abdominal segments. There are nine visible segments on *A. permutata*. Segments one to six are pink in the first three instars; the

Table 1. Body length and clypeus widths of *Aphrophora permutata* Uhler.

Instar	Number Measured	Body Length mm		Clypeus Width mm		SE $\bar{x}$
		Range	Mean	Range	Mean	
I	38	1.7-2.2	2.0	0.35-0.43	0.38	0.0071
II	71	2.7-3.3	3.0	0.50-0.63	0.58	0.0065
III	99	3.8-4.4	4.0	0.75-0.96	0.83	0.0039
IV	69	6.1-6.6	6.3	1.00-1.28	1.18	0.0076
V	64	7.7-9.0	8.3	1.29-1.58	1.39	0.0120

dorsal surface of segment seven is pink with lateral edges and ventral surface white. Segment eight is white, nine black. There are slight variations in coloration of the head and thorax between the second and third instar and the first. The posterior portion of the head and the margins of the prothorax are white in the second and third instars instead of a uniform dark brown as in the first instar.

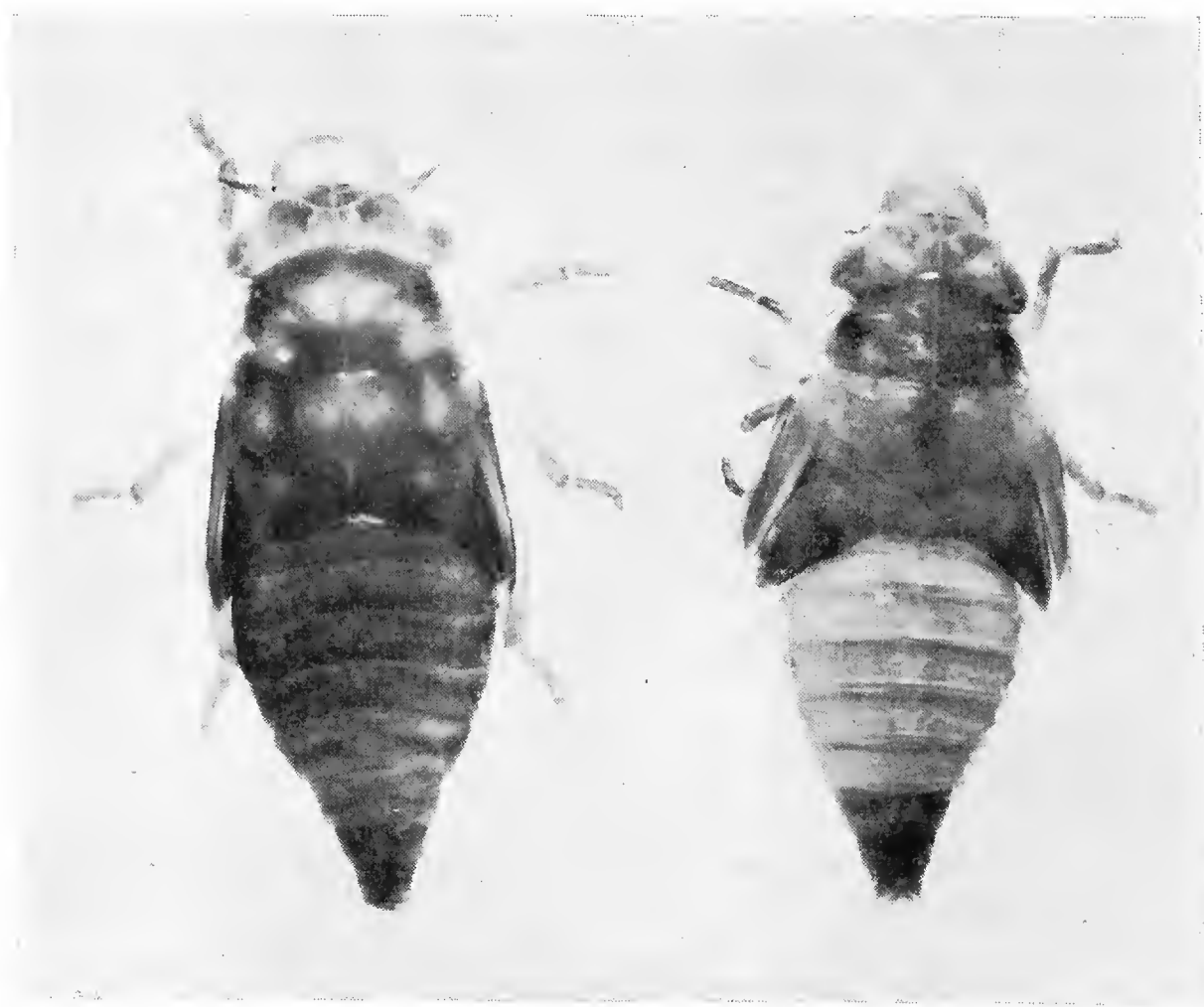
A number of changes appear at the fourth instar. The clypeus changes from brown to white, and while the base color of the prothorax is still brown, it has a large white area on the midline containing two brown spots, one on each side of the midline. There are two white spots on the posterior lateral portions of the prothorax and two thin white patches on the lateral edges. Wing pads are obvious on the mesothorax and both the mesothorax and metathorax are a uniform dark brown. The first to sixth abdominal segments are white with pink lateral edges on segments three to six, segments seven and eight are dark brown, and nine is black.

The fifth instar (Fig. 3) clypeus is mostly brown with a white center. There is a distinct white line across the head just behind the eyes. The ocelli are white. The prothorax shows a large white area on the midline with two brown spots immediately adjacent to the midline and two lateral white spots posterior to the large white area. There are three white spots on the brown background of the mesothorax, two on the lateral edges, and one centered on the segment. The wing pads are well developed. The abdomen is brown with a white longitudinal stripe on the dorsal surface of the segments, giving a striped appearance to the abdomen (not apparent in photograph). Segments two through six are pink on the lateral edges, one and seven are reddish brown, eight and nine are black. There is ventral expansion of the pleurites forming a broad channel beneath, narrowing to leaf-like plates at the tip that are used to enclose air for the formation of bubbles in the spittle mass (Osborn, 1916).

The first instar nymphs drop to the ground from the oviposition site on pine and begin their development on weeds. They are found from late

February to mid-March (Fig. 1). The final instar completes its development late in May to early June. The first three instars prefer the base of weeds with as many as 25–30 individuals clustered in the same spittle mass wetting the ground under the plant. During the last two instars they are found spread out as individuals higher on the plant.

The process of molting from the last instar to the adult stage has been described by Severin (1950). The nymph leaves its spittle mass and crawls to a petiole or stem where it firmly attaches its claws. It then covers the lower surface of the abdomen and thorax with spittle that after drying glues these parts to the plant surface. The head and prothorax are bent down and the prothorax becomes swollen. The prothorax of the old exoskeleton splits longitudinally along the dorsomedian line. After ecdysis, this split in the exuvia extends from the head region to the end of the thorax. During ecdysis, the dorsal portion of the prothorax is pushed out first followed by the head, the rest of the thorax, and finally by the abdomen. The tip of the abdomen remains attached to the exuvia for



EXPLANATION OF FIGURE

Fig. 3. Fifth instar nymphs of *A. permutata* (left photograph) and *A. canadensis* (right photograph).

30 or 40 minutes, acting as a point of attachment for the adult. The adult hangs head down while the body fluids expand the new integument in a process not dissimilar to the expansion of a butterfly's wings. The adult then grasps the exuvia or stem and disengages the tip of the abdomen. During the molting process the body is white except for the ocelli which are bright red.

The adult insect can be found from late May to the last week in September. Both sexes emerge at about the same time. After emergence the adults fly to the pine (Doering, 1942) and are found feeding on the underside of the stems but not on the needles. Second-year growth is preferred. They are very quiet, but if disturbed they will fly with a rapid, darting motion. As one approaches the tree, adults will fly in every direction, frequently hitting and momentarily remaining on pants or shirt. During feeding, a considerable amount of honeydew exudes from the abdomen. Adults may often be located by the large drops on needles directly below their feeding position. They are usually oriented with the head pointed towards the tip of the stem. Copulation takes place while the adults are resting on the stem. Both sexes seem to continue feeding during copulation. The adults have not been observed feeding on any plant other than pine. Copulation takes place a few days after emergence, shortly after which eggs are laid. The adult has been fully described by Severin (1950).

The economic importance of this insect would seem to be minor. Keen (1952) reported injury to Monterey pine and other pines, spruce, and firs in all the western states. When eggs are deposited, the needle commonly dies from that point to the tip. In a few cases when only one to three eggs are laid, only a small area surrounding the eggs dies. This condition is similar to that reported by Fisher and Allen (1946) on alfalfa. The number of needles affected (less than 1 per cent of the total on a tree) is so slight that the damage caused is not noticeable. The adults feed on the stems, a noticeable amount of honeydew resulting. This feeding does not cause noticeable damage to the tree. The honeydew does attract ants, however. Severin (1950) did not find virus-infected pine trees. In summary, the adult feeding and oviposition damage to pine trees is not extensive enough to cause any significant degree of damage at this time. However, the damage resulting from other spittlebugs with similar habits indicates that *A. permutata* could conceivably become a forest and ornamental tree pest.

OBSERVATIONS ON *APHROPHORA CANADENSIS* WALLEY

This *Aphrophora* species apparently completes its entire life cycle on Monterey and knobcone pine (*P. attenuata* Lemmon) in the Monterey and San Francisco Bay areas. There is only one generation per year (Fig. 1).

Table 2. Body length and clypeus widths of *Aphrophora canadensis* Walley.

Instar	Number Measured	Body Length mm		Clypeus Width mm		SE $\bar{x}$
		Range	Mean	Range	Mean	
I	73	2.0-2.3	2.2	0.36-0.45	0.40	0.0053
II	116	2.8-3.2	3.0	0.50-0.61	0.56	0.0049
III	81	3.6-4.4	4.0	0.75-0.83	0.78	0.0061
IV	114	4.8-5.6	5.2	0.91-1.11	1.03	0.0051
V	106	7.0-7.4	7.2	1.13-1.44	1.24	0.0095

Eggs were not found but all nymphal stages and adults were found on the growing tips of young and mature pines. First instar nymphs were found in early April, last instar in mid-July. Adults were found from early July to early October. It is assumed that oviposition occurs in October and that the eggs overwinter.

Oviposited eggs were not found but dissection of several females yielded eggs similar in size and general shape to those of *A. permutata* and *A. saratogensis*. The occurrence of first instar nymphs on the growing tips of pines suggests that the oviposition site must be nearby. It does not seem reasonable to expect a first instar nymph to find its way from another host to the tops of tall trees. In the closely related *A. saratogensis* (Fitch), Giese and Wilson (1958) found the eggs laid singly or in rows between the bud scales on terminal and lateral buds of red pine.

There are five nymphal instars (Table 2). The occurrence of these in the field is shown schematically in Fig. 1. The head and thorax of the first four instar nymphs are shiny black. The first to eighth abdominal segments of the first instar are white with the lateral edges of segments three through six pink. Segment nine is black. The lateral edges of segments four through six are pink in the second instar. The ventral surface of the eighth has four distinct parallel longitudinal black bands. The only color change occurring at the third instar is on the eighth segment which is black on the lateral surface as well as the ventral. The fourth instar possesses wing pads. Segments seven and eight are black on the lateral edges, nine is entirely black. The pleural lobes of all abdominal segments have distinctive black borders. The ventral expansion of the pleurites, specialized to form air bubbles, is apparent.

The greatest color change appears at the fifth instar. The clypeus is light brown with a darker brown border. The ocelli are pink. Thoracic segments are a uniform brown color with the exception of the metathorax, which has two white spots centered between the midline and lateral edges. Wing pads are fully developed. Abdominal segments one through six are

light tan (almost white) and seven, eight, and nine are black. The ventral surface of the abdominal pleurites is black.

The fourth and fifth instars of *A. permutata* and *A. canadensis* can be easily distinguished. The clypeus, head, thorax, and wing pads of the latter are brown whereas the clypeus of the former is white and the head, thorax, and wing pads are brown with white patches. The abdominal segments of *A. permutata* are predominantly brown while those of *A. canadensis* are white on the dorsal surface except for the last three segments which are black.

The favored feeding sites of the nymphs are the pine needles, the bases of needles, and on green cones. Feeding on green cones is on the surface adjacent to the branch to which the cone is attached. As many as 25 or 30 individuals may be found in one spittle mass. The spittle masses are often large enough to hang down to the next branch. Molting of the various instars takes place within the spittle mass.

The distribution of collection sites indicates that this species is restricted to coastal areas where fog is frequent. The San Francisco Bay area is bordered on the east by a mountain range, approximately 1,000 feet high, and coastal fog extends inland only short distances. The local distribution of *A. canadensis* is restricted to the bay area up to the crest of the coastal range. East of the range only *A. permutata* was found. Fifty nymphs of *A. canadensis* were transferred from Berkeley to Concord, California, approximately 18 miles inland; none developed to the adult stage.

The restriction of *A. canadensis* to foggy areas whereas *A. permutata* is found more widely distributed in areas of no fog is believed to be due to the differences in seasonal occurrence of their nymphal stages. *A. canadensis* nymphs appear almost 2 months later than *A. permutata* and are in an exposed portion on the tree whereas nymphs of the latter are in close proximity to the ground in a more humid environment. Evans (1940) considers the spittle mass to be a protective mechanism against excessive loss of moisture. However, it is believed that the spittle mass produced by *A. canadensis*, although large, is not sufficient to protect the nymphs during the hot June and July weather in fogless areas.

The molting process and ecdysis of *A. canadensis* is not distinctly different from *A. permutata*. This may have added to the confusion of *A. permutata* and *A. canadensis* in Severin's (1950) description of the life history of *A. permutata*. The adult *A. canadensis* is a less active insect than *A. permutata*. It is not as prone to fly up from the tree when one approaches. It rests for long periods on the pine stem, hardly moving. During feeding it gives off honeydew but not in the copious quantities of

A. permutata. Copulation takes place while the adults are resting on a stem. The adult insect has been collected from the second week in July until the first week in October.

Aphrophora canadensis Walley was observed to build up to a level in the nymphal stages so that needle drop similar to that observed on red pine and jack pine by Secrest (1944) and Eaton (1955) occurred. Heavy infestations of this kind with masses of spittle hanging down from stems and cones are unsightly on an ornamental tree and would require control measures. Green cones turned brown where groups of nymphs were feeding, presumably causing some damage to the seed. An undesirable side effect of the feeding of the adult is the attraction of ants to the honeydew.

SUMMARY

The biology and life stages of *Aphrophora permutata* Uhler and *Aphrophora canadensis* Walley are described. Both insects overwinter in the egg stages on pine trees. The eggs of *Aphrophora permutata* hatch in late February. Five nymphal instars follow. These are found feeding on native weeds in the vicinity of the pines. On emerging in late May, the adults fly to the pine trees where mating and oviposition follow in about 2 weeks. The adults are found as late as the last week in September.

All stages of *Aphrophora canadensis* (oviposition site not found) are found on Monterey pine and other *Pinus* species. First instar nymphs are found during the second week in April. Adults appear in mid-July and are found until the first week in October.

These two insects are found together on pine trees over part of their range. Confusion has resulted from the similarity between the first four instars of these two insects. Adult *Aphrophora permutata* can be found on the same trees containing early instars of *Aphrophora canadensis*. If a freshly obtained series of nymphs of both species are observed, *Aphrophora canadensis* has a decidedly darker head and thorax in instars one through four. A number of differences have been described to differentiate the fourth and fifth instars of these species.

The distribution of *A. canadensis* is restricted to foggy areas whereas *A. permutata* is widely spread in less humid regions. This difference is presumed to be caused by the difference in the nymphal habitat, those of the former occurring on exposed locations in the crowns of pine, the latter on weeds on the ground. Also, the later development of *A. canadensis* exposes the nymphs to higher temperatures and more arid conditions.

ACKNOWLEDGMENTS

I would like to thank Dr. J. W. MacSwain, Professor of Entomology, Department of Entomology and Parasitology, and Dr. Harold F. Heady,

Professor of Range Management, School of Forestry, University of California, for their help and critical review of this manuscript. Particular thanks are due Dr. Ronald W. Stark, Associate Professor of Entomology, for his guidance and assistance throughout the study and Dr. K. Doering, University of Kansas, Lawrence, for her determination of the species studied.

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New Species and Distribution of *Dianthidium*
in North America

(Hymenoptera : Megachilidae)

ALBERT A. GRIGARICK AND LIONEL A. STANGE

University of California, Davis

A survey of the pollen-gathering Anthidiini in several museums of western North America plus recent collections has revealed two new species of *Dianthidium*. Members of this genus have a dark base color but are brightly marked with yellow, white, or reddish-brown maculations and are distinguished from species of related genera by a lamellate pronotal lobe and a spur on the hind coxa.

On the basis of the males, the two new species can be placed within the group of *Dianthidium pudicum* (Cresson) as characterized by Timberlake in 1943. The morphological feature common to this group is the median lobe of the pygidium which is rather long and curved downward so that the apex lies below the level of the lateral lobes. The females of the genus are not as conveniently divided into groups. However, the new species are readily distinguished from other females in the genus by the combinations of morphological structures given in the descriptions and figures. The figures were rendered by Miss Judy Jay.

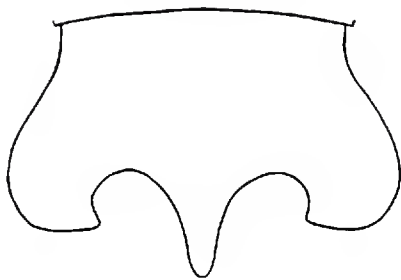
KEY TO MALES OF THE GROUP OF DIANTHIDIUM PUDICUM (CRESSON)

- 1. Frontal area between antennal sockets relatively flat; sternite VI broadly rounded or tapered to apex, width at apex one-third or more median width of sternite 2
Frontal area with paired, impunctate, crescent-shaped protuberances arising between antennal sockets; sternite VI narrowly tapered to apex, width at apex one-fourth or less median width of sternite *D. marshi* Grigarick and Stange
- 2. Punctures of frons fine, each one-fourth or less diameter of median ocellus; sides of sternite VI with concave taper to apex 3
Punctures of frons relatively coarse, each about one-half diameter of median ocellus; sides of sternite VI convexly rounded to apex

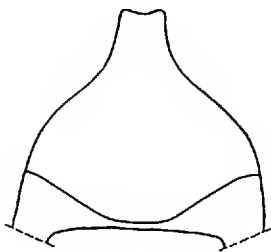
D. parkeri Grigarick and Stange
- 3. Apex of sternite VI evenly rounded or with weak emargination, red-brown; apex of sagittal lobe of genitalia distally directed, narrowly tapered or bluntly rounded 4
Apex of sternite VI prominently incised, wide transparent margin; apex of sagittal lobe acute, mesially directed *D. pudicum* (Cresson)
- 4. Sagittal lobe of genitalia distally tapered to narrow apex; abdominal tergites with or without red-brown bands adjacent to impunctate marginal bands

D. dubium Schwarz

Sagittal lobe bluntly rounded; tergites without red-brown bands adjacent to marginal bands *D. plenum* Timberlake



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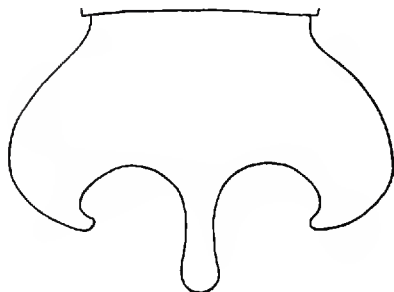


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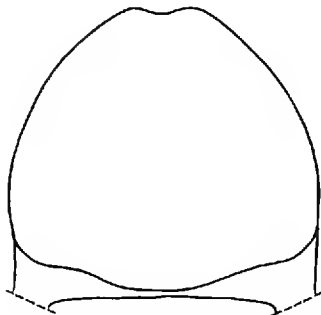
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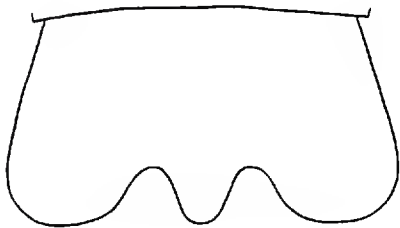


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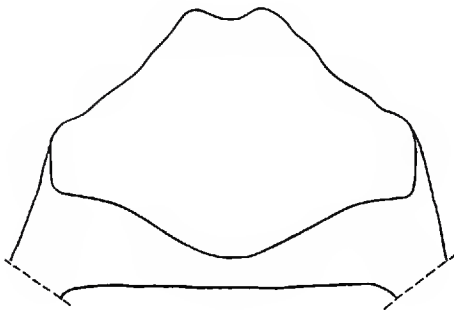
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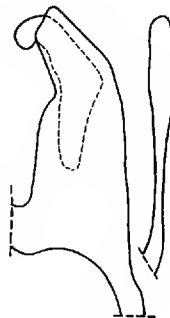


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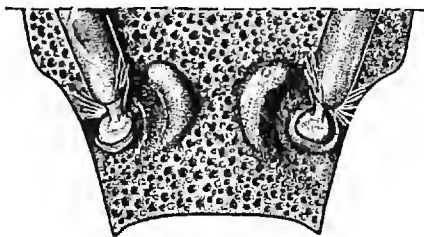


8

implicatum



9



10

marshi



11



12

parkeri

***Dianthidium marshi* Grigarick and Stange, new species**

(Figs. 1, 2, 3, 10, 11)

MALE.—Base color black with yellowish-white markings as follows: mandible, clypeus, paraocular marks narrowed dorsally, triangular supraclypeal spot, paired interantennal spots, postocular stripe; thorax with paired, lateral marks on anterior margin of mesoscutum; axilla; apical margin of scutellum; band on tegula and pronotal lobe; minute spot on mesopleura; paired meso-, metasternal spots; legs with small spot on pro-, mesocoxa, extensive on spine and process of metacoxa; apex of femur, stripe on pro-, mesofemur; tibia with exterior stripe, enclosing dark spot on metatibia; exterior stripe on basitarsus; abdomen with tergites I to VI each with a band, sublaterally with posterior emarginations, interrupted medianly III to V; pygidium entirely maculate except for hyaline edges and proximal margin; posterolateral margins of sternites I to V with spots. Ferruginous areas as follows: mouthparts except mandible; crown of tegula; tarsal segments II to V; apical margins of abdominal tergites I to VI, subapical band on tergites I and II, extensive on sternites; genitalia. Flagellum dark brown. Wings infuscated, darker in costa and apical one-third of forewing. Punctures of frontal area about one-fourth or less diameter of median ocellus, mostly separated by distances less than their diameters, interstitial lines unsculptured, presenting shiny appearance. Punctuation interrupted slightly above and between antennal sockets by paired elevated protuberances, the latter smooth and comma-shaped as in Fig. 10. Punctures of mesoscutum separated by finely sculptured but shiny interstitial lines about one-half as wide as puncture diameter, punctures slightly denser and smaller on anterior middle. Pubescence whitish; mostly sparse and short except for pleural regions of thorax and long, sparse setae on sternites; reddish on inside of tarsi and median setal comb of sternite III, setal comb occupying median one-fourth of sternite margin. Middle lobe of pygidium extended beyond and below plane of lateral lobes, dorsal outline as in Fig. 1. Apex of sternite VI narrow, truncate as in Fig. 2. Genitalia with sagittal lobe and stipes as in Fig. 3, volsella a single wide lobe with apex nearest stripes, all structures without prominent pubescence. Length, 9.0 mm; forewing 5.6 mm; width of abdomen, 2.75 mm.

FEMALE.—Similar to male but differing as follows: mandible (Fig. 11) nearly entirely ferruginous; maculation of clypeus reduced to large lateral spots, apical margin ferruginous; supraclypeal, interantennal, mesopleural, and meso-, metasternal spots absent. Metacoxal spine reduced, ferruginous; yellowish-white markings on tibia limited to basal spot, absent on basitarsi. Ferruginous subapical bands of abdominal tergites wider; yellowish-white bands less extensive, reduced to two spots on V; VI entirely black. Face of pygidium rather flat, transverse apically, margin gently curved posteriorly. Punctures of mesoscutum finer, denser; interstitial lines narrower and more prominently sculptured, presenting a general duller appearance than frons. Abdominal sternites covered with dense scopa, terminal sternite weakly tapered to acute apex. Length 8.0 mm; forewing 5.25 mm; width of abdomen, 2.75 mm.

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EXPLANATION OF FIGURES

Figs. 1, 4, 7. Pygidium of male. Figs. 2, 5, 8. Sternite VI of male. Figs. 3, 6, 9. Sagittal lobe and stipes of male genitalia. Fig. 10. Interantennal protuberances. Figs. 11, 12. Mandible of female.

The *holotype male* was collected FIVE MILES WEST OF BIG PINE, INYO COUNTY, CALIFORNIA, on 10 July 1961, by P. M. Marsh and the paratype female at the same locality 10 August 1962, on *Eriastrum densifolium*, by L. A. Stange. These types are deposited at the California Academy of Sciences, San Francisco, California.

The tridentate pygidium of the male and rather transverse apical margin of the pygidium of the female associate this species with those assigned to the group of *Dianthidium pudicum* (Cresson) by Timberlake (1943). The reddish subapical bands of tergites I and II of both sexes and the shape of the mandible of the female place it closest to *D. dubium*, but it is readily distinguished from all species in the United States by the presence of protuberances between the antennal sockets on both sexes and by distinct differences in the shapes of sternite VI (male) and the sagittal lobe of the male genitalia.

***Dianthidium parkeri* Grigarick and Stange, new species**

(Figs. 4, 5, 6, 12)

MALE.—Base color black with pale yellowish-white markings as follows: mandible, clypeus, paraocular marks tapered dorsally, triangular supraclypeal spot; thorax with paired lateral spots on anterior margin of mesoscutum; axilla; apical margin of scutellum; band on tegula and pronotal lobe; metacoxal spine; posterior, distal margin of trochanter; spot on apex of femur, stripe on pro-, mesofemur; tibia with exterior stripe, interrupted on pro- and metatibia, exterior stripe on basitarsus; abdomen with tergites I to V each with a band, sublaterally with emarginations completely broken on I and II, interrupted medianly on III to V; pygidium completely maculate except for hyaline margin and basal half. Dark ferruginous areas as follows: mouthparts except margin of mandible and labrum; crown of tegula; tarsal segments II to V; apical margins of abdominal tergites I to VI, apex of middle lobe of pygidium; most of sternites; genitalia. Flagellum dark brown. Wings infuscated, darkest in costa and marginal cell. Frons shiny, punctures coarse, about one-half as wide as diameter of median ocellus, becoming denser between antennae; interstitial lines smooth, about one-half as wide as punctures. Mesoscutum shiny, punctures fine, about twice as dense as frons, interstitial lines very lightly sculptured. Pubescence whitish, short, mostly sparse; longer, denser on back of scape, pleural regions of thorax, lateral margins of abdominal tergites and sternites, face of tibia and tarsi. Pubescence reddish on inside of tarsi; pale reddish-white setal comb on sternite III covering median one-fifth of segment margin. Median lobe of pygidium extended beyond and below plane of lateral lobes, round apex dilated, dorsal outline as in Fig. 4. Distal half of sternite VI evenly rounded, apex slightly emarginate (Fig. 5). Genitalia with sagittal lobe and stipes as in Fig. 6, volsella narrowly tapered and curved to apex proximal to stipes, without prominent pubescence. Length, 9.0 mm; forewing, 5.75 mm long; width of abdomen, 2.75 mm.

FEMALE.—Similar to male but differing as follows: mandible (Fig. 12) and clypeus black, paraocular stripe strongly emarginate near antennal base; metacoxal spine reduced, black; stripe on pro-, mesofemur greatly reduced; absent on meta-femur; stripe reduced to proximal end on tibia, absent on basitarsus. Abdominal

bands on tergites reduced, sublateral emarginations extended through band except on III, V reduced to two spots, VI entirely black. Punctures on mesoscutum finer and denser than on frons, interstitial lines prominently sculptured, middorsal area appears dull. Abdominal sternites covered with dense white scopa. Apex of terminal sternite bluntly rounded. Distal two-thirds of pygidium margin relatively transverse, without prominent apical rim, face weakly rounded. Length, 7.0 mm; forewing 5.5 mm long; width of abdomen 2.75 mm.

Holotype male and paratype female collected at TUCSON, ARIZONA, 29 May 1962, by F. D. Parker and L. A. Stange and are deposited at the California Academy of Sciences. Other paratypes are as follows: ARIZONA—three males, three females, Tucson, 27 to 29 May 1962 (F. D. Parker and L. A. Stange); two males, one female, Mt. Lemmon Road, 3,500 feet, 15 August 1954; one female, Oak Creek Canyon, 4,000–5,000 feet, 11 June 1940 (R. M. Bohart); one male, Portal, 16 September 1955 (G. E. Bohart); one female, Sabino Canyon, Pima County, 4 September 1961 (L. A. Stange); one male, Tucson, May 1924; one female 10 miles south Tucson, August 1940 (E. S. Ross); one female east end Roosevelt Lake, 23 August 1953 (G. D. Butler); one male, Sabino Canyon Station, Catalina Mountains, 6 June 1953 (R. S. Beal); one female, 5 miles northwest Ft. Huachuca, 10 July 1952, taken on *Verbesina encelioides*; and one male, Santa Rita Mountains, 10 June 1952 (Beamer, LaBerge, Liang). TEXAS—three males, Santa Elena Canyon, Big Bend National Park, 2,145 feet, 25 August 1954 (R. M. Bohart). NEW MEXICO—one male, 7 miles southeast Rodeo, Hidalgo County, 21 August 1958 (R. M. Bohart). MEXICO—one male, 11 miles north Culiacán, Sinaloa, 20 May 1962; three males, Aduana, Sonora, 15 March 1962 (F. D. Parker, L. A. Stange); one male, San Juan del Rio, Durango, 5,200 feet, 30 July 1957 (C. D. Michener). These paratypes will be deposited at the American Museum of Natural History, the University of California—Berkeley, Davis, and Riverside, and the University of Nebraska.

This species also falls in the *D. pudicum* group because of the shape of the pygidium. *D. parkeri* shows similarities to *D. dubium* with respect to the rounded apex of sternite VI in the male and the curved cutting edge of the mandible of the female. It is easily distinguished from all species of this group by the large, widely spaced punctures of the frons of both sexes, the truncate pygidium of the female, and genitalic differences in the male.

The color and maculation vary to some extent within the paratype series, sometimes between specimens from the same locality. The color of the maculation ranges from white to pale yellowish-white to lemon yellow. The black areas of parts of the head, legs, and abdomen are dark brown on some specimens. The extent of maculation varies on most regions of the body. Some paratypes have a dorsal genal spot; and the supraclypeal

spot is nearly missing on one male. Abdominal markings vary in the size of the sublateral emarginations and the median interruption of the bands of the tergites. Tergite VI is nonmaculate on all females, but a trace of a narrow median band is present on this segment of some paratype males.

DIANTHIDIUM IMPLICATUM Timberlake, 1948

(Figs. 7, 8, 9)

The holotype female of this species was described in 1948 from Morongo Valley, San Bernardino County, California. The male was then unknown. It is here described from specimens collected in several states.

MALE.—Black with pale yellowish-white maculations as follows: mandible, clypeus, triangular supraclypeal spot usually present, paraocular stripe tapering dorsally, small postocular spot; thorax with paired lateral spots on anterior margin of mesoscutum; axilla; band on posterior margin of scutellum; band on base of pronotal lobe and anteriorly on tegula; legs with metacoxal spine maculate; femur with distal spot and ventral stripe, reduced on metafemur; stripe on tibia, may be interrupted distally, widely so on metatibia; basitarsi with stripe, sometimes reduced on pro-, mesotarsi; abdomen with transverse bands on tergites I–VI, emarginate sublaterally, emargination usually completely through band on tergites I, II, VI; generally interrupted medianly on III–V; band on VI may be nearly absent; pygidium entirely maculate except for base and hyaline margin. Ferruginous markings as follows: mouthparts except for labrum, mandibles; crown of tegula; tarsal segments II–V; abdominal sternites, impunctate rim of tergites I–V, entire dark area of tergite I, most of that of II, subapical margin of II–V or limited to I–II. Flagellum, dark areas of legs, abdomen may be dark brown. Wings infuscated, costa and marginal cell darkest. Punctures of frons coarse, well separated by polished interstices of varying widths; mesoscutum with finer, closer punctures, sculpture of interstitial lines usually moderate but may be nearly absent; punctures of pygidium sparse, widely and irregularly separated. Pubescence whitish, prominent, denser and longer on pleural regions; setae on inside of tarsi reddish; fine, pale-reddish hairs of median comb on sternite III covering slightly more than one-third segment width; dark, reddish setal patch on underside of median lobe of pygidium of variable width. Dorsal outline of pygidium as in Fig. 7; median lobe placed above lateral lobes in profile; emarginations separating lobes somewhat variable—which slightly varies the length and width of median lobe. Sternite VI as in Fig. 8. Genitalia with sagittal lobe and stipes as in Fig. 9. Volsella broadly and evenly rounded. Length, 8.0–10.0 mm; forewing 5.5–7.0 mm long; width of abdomen 2.75–3.25 mm.

The male of *D. implicatum* has a short median lobe on the pygidium. In this respect, it resembles species in the *curvatum* and *parvum* groups as characterized by Timberlake in 1943. It is distinguished from males of these groups by the widely spaced punctures on the pygidium and frons, and the unique sagittal lobe of the genitalia.

The description is based on males from the following collections which include new distribution records for the species: ARIZONA—one female, Huachuca Mountains, 20 June 1933 (E. D. Ball). CALIFORNIA—one male,

Mazourka Canyon, Inyo County, 2 July 1953 (W. D. McLellan); two females, Antelope Springs, Inyo County, 10 July 1961 (R. M. Bohart); two males, one female, 4 miles southeast Pearblossom, Los Angeles County, 21 August 1954, on *Gutierrezia lucida* (R. R. Snelling); two females, Scissors Crossing, San Diego County, 4 July 1956 (R. M. Bohart, A. Menke, Jr.); Windmill Station, San Bernardino County, 28 May 1950 (C. D. MacNeill). NEVADA—one male, 6 miles southwest Arden, Clark County, 1 July 1961 (F. D. Parker); one female, Mercury, 7 June 1957 (R. S. Dutra); one female, Fairbanks Springs, Ash Meadows, Nye County, 23 June 1951 (T. Frantz). NEW MEXICO—four males, three females, Rodeo, Hidalgo County, 15 June 1947 (A. T. McClay). TEXAS—three males, one female, Persimmon Gap, Big Bend National Park, 20 August 1954 (R. M. Bohart). MEXICO—one female, La Cruz, Chihuahua, 13 July 1957, on *Cerallia sinuata* (C. D. Michener).

NEW RECORDS

- D. cressonii* (Dalla Torre). One male, one female, 6 miles east Currant, Nye County, Nevada, 24 June 1960 (G. I. Stage); one female, Farrington Ranch, Nye County, Nevada, 12 September 1962, on *Chrysothamnus viscidiflorus* (R. C. Bechtel); one female, 10 miles east Panaca, Lincoln County, Nevada, 29 August 1960 (F. D. Parker); one female, Albuquerque, New Mexico, 5,000 feet, 8 July 1945 (W. O. Griesel).
- D. curvatum sayi* Cockerell. One male, one female, 15 miles north Bishop, Inyo County, California, 5 August 1948 (P. D. Hurd, J. W. MacSwain).
- D. discors* Timberlake. One female, Pima County, Arizona, 2 February 1928, reared from sand cocoons (C. T. Vorhies).
- D. heterulkei fraternum* Timberlake. Fifteen males, 15 females, Chisos Mountains, Big Bend, Texas, 6 July 1942 (E. C. Van Dyke); one male, Charcoal Ovens State Park, White Pine County, Nevada, 12 September 1962 (T. R. Haig).
- D. heterulkei heterulkei* Schwarz. One male, Duck Creek Camp, Kane County, Utah, 11 July 1961 (G. F. Knowlton).
- D. parvum parvum* (Cresson). One male, Sky Ranch, Reno, Washoe County, Nevada, 4 July 1952 (R. C. Bechtel); one female, Minden, Douglas County, Nevada, 3 June 1960, on *Artemisia tridentata* (F. D. Parker); one female, 10 miles north Winnemucca, Humboldt County, Nevada (R. C. Bechtel).
- D. platyurum platyurum* Cockerell. One male, one female, 20 miles west Arden, Clark County, Nevada, 27 September 1957 (R. C. Bechtel); one female, Mountain Springs Summit (5,400 feet), Clark County, Nevada, 13 August 1959 (F. D. Parker); two males, 5 miles east Carson City, Ormsby County, Nevada, 17 August 1961 (R. C. Bechtel).
- D. plenum plenum* Timberlake. One male, Galena Creek (6,300 feet), Washoe County, Nevada, 26 July 1959 (F. D. Parker); one female, Verdi, Washoe County, Nevada, 26 June 1962, on *Orobanche comosa* (F. D. Parker).
- D. subparvum subparvum* Swenk. Two males, 16 miles south Ely, White Pine County, Nevada, 11 September 1959 (T. R. Haig); one female, 11 miles south Ely, White Pine County, Nevada, 2 July 1960 (T. R. Haig); one female, Charcoal Ovens

- State Park, White Pine County, Nevada, 29 June 1960 (T. R. Haig) ; one female, Dagget Pass, Douglas County, Nevada, 24 August 1952 (R. C. Bechtel).
- D. subrufulum* Timberlake. One male, New Braunfels, Comal County, Texas, 1 August 1952 (M. Wasbauer).
- D. ulkei perterritium* Cockerell. One hundred sixty-one males, 255 females (predominantly Chiricahua Mountains), southwestern Arizona, 12 July to 6 September 1958 (numerous collections) ; two females, Chadron, Nebraska, 20 August 1961 (R. W. Dawson).
- D. ulkei ulkei* (Cresson). Five males, 5 females, Washoe Lake, Washoe County, Nevada, 16 August 1962 (F. D. Parker) ; one male, one female, Elko, Elko County, Nevada, 4,000 feet, 31 August 1953 on *Grindelia* (G. I. Stage).

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BOOK NOTICE

THE FRUIT FLIES OR TEPHRITIDAE OF CALIFORNIA. By Richard H. Foote and F. L. Blanc. Bulletin of the California Insect Survey, Vol. 7, 117 pp., colored frontispiece, Figs. 1-118, maps 1-104. 15 June 1963. University of California Press, Berkeley and Los Angeles. Price \$4.00.

This work, which is a most welcome addition to our knowledge of California Diptera, records a total of 105 species of Tephritidae. Indicative of California's rich fauna, this total is slightly less than one-half of the species known from all of North America north of Mexico. Complete collection data are recorded from all studied California specimens (from 39 collections) and distributional maps are given for each species. In addition to the attractive colored frontispiece which illustrates two species on their host plants, the distinctive wing pattern of each species is illustrated by a good photograph. Useful host and trap record lists are also provided.—PAUL H. ARNAUD, JR., *California Academy of Sciences, San Francisco*.

**Occurrence in California of *Oinophila v-flava*, a Moth
Probably Introduced from Europe**

(Lepidoptera : Tineoidea)

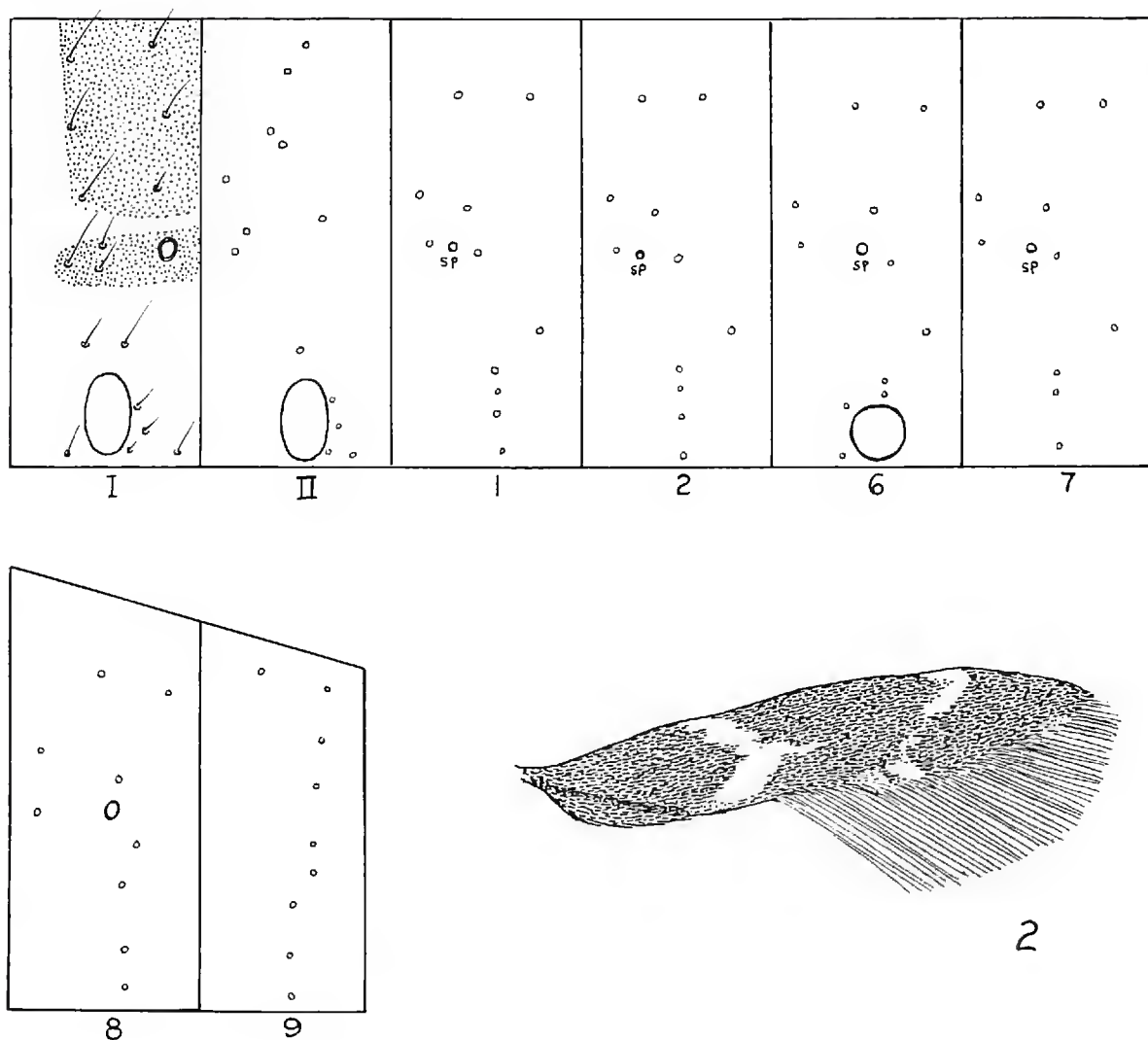
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The genus *Oinophila* is monotypic and has been related by various authors to *Bucculatrix* of the Lyonetiidae. It has appeared in recent lists as a separate family, Oinophilidae. *Oinophila v-flava* (Haworth) is a small, brownish moth having the forewing marked with outwardly oblique ochreous dashes, usually forming a conspicuous V-shaped mark across the middle of the wing (Fig. 2). The species ranges through much of Europe, from England and Ireland to Germany and Spain, and occurs in the Madeira and Canary Islands (Meyrick, 1895; Corbet and Tams, 1943). It was reported in California by Tilden (1951) who reared a single specimen at Stanford in 1947. At that time Carl Heinrich of the U. S. National Museum informed Tilden that no other North American records were known. During the past several years the moth has been collected at San Francisco Bay area localities as well as at San Diego, and specimens in the California Academy of Sciences and State Department of Agriculture indicate that the species was taken at Sacramento and in southern California 20 to 30 years ago. In addition, the Academy has a single specimen from the Koebele collection labelled "Los Angeles Co., Apr." which probably was collected by Coquillett during his stay in Los Angeles between 1883 and 1892.

Although the species is now known to be widespread in California, its distribution, primarily near coastal cities, suggests that *O. v-flava* is introduced here. Lack of records from other parts of North America supports the hypothesis that it is not a native Holarctic species. Whether the moth has been established in California since the 1880's is not known. The records are widely disjunct chronologically and may represent two or more separate introductions, but colonies of *O. v-flava* are very inconspicuous and may have escaped notice during the intervening years (as well as at other localities). The moths do not seem to be strongly attracted to lights. Although *O. v-flava* is known from four localities in the San Francisco Bay area, there are no definite records of its attraction to light despite extensive sampling at lights during the past seven years at many spots in this region.

Presumably the species is a scavenger in the larval stage. Various general works have reported that the larvae live in silken galleries amongst fungus on walls of cellars and bore into corks of wine bottles (Stainton,



EXPLANATION OF FIGURES

Figs. 1-2. *Oinophila v-flava* (Haworth). 1, Setal pattern, final instar larva showing thoracic segments I (with sclerotized areas indicated) and II and abdominal segments 1, 2, and 6 to 9. 2, Forewing pattern of *O. v-flava*, distinctly marked form.

1859; Meyrick, 1895; Ford, 1949). In their work on stored food products Corbet and Tams (1943) list the larval food as dried vegetable matter. In California the species has been reared in various situations which suggest similar habits. Specimens from Ventura County are labelled as having been reared from "cocas palm" (possibly *Arecastrum romanzoffianum*), and Tilden (1959) obtained the moth incidentally from *Baccharis pilularis* (Compositae), a native plant, which was caged for rearing other Microlepidoptera. In 1960 I received larvae of this species which were feeding in bark of "flowering locust," another alien plant, collected at San Jose. The chunks of bark were housed in a damp container and were noted to be covered with mould. Adults of *O. v-flava* emerged from the collection between 18 January and 8 February 1960.

In Europe Ford (1949) and others have reported a single annual generation for *O. v-flava*, the larvae feeding in May and June, and the moths

flying in July and August. Records in California have shown emergences of the adults at various times of year. Possibly the moderate climate of coastal California enables year-round activity.

The larva seems not to have been described, and may be briefly characterized as follows (based on two presumably last instar specimens from San Jose) :

Length about 8.4 mm (distended in preservative), body elongate, thin (width about 0.7 mm), white. Head subrectangular, width about 0.58 mm, length about 0.51 mm; somewhat dorsoventrally flattened; dark amber-brown, paler at sides; postclypeal index about 1.1; mandible with three strongly curved, overlapping cusps, somewhat flattened, scythe-like in appearance. Setal arrangements as in Fig. 1. Prothoracic shield and lateral pinaculum, and anal shield pale yellow-brown. Abdominal prolegs with crotchets uniordinal, uniserial, about 17–18 forming a mesal penallipse; anal crotchets uniordinal, uniserial, about 11–12; anal fork absent.

California material examined.—Sacramento County: Sacramento, 1 ♀ 12 May 1933, 2 ♂ 11 May 1943 (H. H. Keifer). Contra Costa County: Walnut Creek, 1 ♀ 21 July 1963, 2 ♀ 17 October 1963 (J. Powell). San Mateo County: Redwood City, 1 ♂ 14 August 1959, 1 ♀ 15 October 1959 (P. H. Arnaud, Jr.). Santa Clara County: Stanford University, 1 ♀ reared from *Baccharis pilularis*, emerged 28 April 1947 (J. W. Tilden) ; San Jose, 5 ♂, 4 ♀, 2 larvae 30 November 1959, reared from “flowering locust” bark, emerged 18 January to 8 February 1960 (JAP-60A2) (L. B. McNelly). Ventura County: “Ventura Co.,” 3 ♂, 5 ♀ August 1942, reared from “cocas palm,” emerged 14 October to 27 October 1942, 1 ♂, 4 ♀ reared from palm tree bark, emerged 24 October 1942, 6 ♂ 17 September 1942, reared from cocas palm, emerged 12 November 1942 to 9 December 1942 (Korsmeier). Los Angeles County: “Los Angeles Co.,” 1 ♂ “Apr.” (Koebele collection). Orange County: Orange, 1 ♂ 26 March 1943 (H. H. Keifer). San Diego County: San Diego, 10 ♂, 1 ♀ 6 August 1959 (W. W. Jones).

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Descriptions and Records of Mexican Methiini

(Coleoptera : Cerambycidae)

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Subsequent to the completion of the review of Mexican and Central American Methiini (Chemsak and Linsley, 1964), additional material has been received from various institutions. New species in the genus *Methia* and *Coleomethia* are represented along with additional distributional records for previously described methiines.

Methia violaceipennis Chemsak and Linsley, new species

MALE.—Form slender, parallel; elytra dark with a violaceous cast, prothorax testaceous, appendages, underside, and frequently head dark brown; integument vaguely, shallowly punctate, sparsely pubescent. Head wider than pronotum; eyes separated on vertex by about diameter of third antennal segment, broadly separated beneath by a distance greater than diameter of antennal scape, upper and lower lobes connected by a single row of facets; antennae extending about four segments beyond body, scape with apical tooth absent, erect hairs of segments about as long as diameter of segments, internal cilia sparse. Pronotum broader than long, sides slightly angulate behind middle, base strongly constricted; disk shallowly punctate, scabrous, with a longitudinal callus on each side of middle, pubescence sparse, long, erect; stridulatory plate of mesonotum not grooved. Elytra about 2.5 times as long as broad, extending to apex of fourth abdominal segment; each elytron with a distinct median costa; punctation shallow, irregular, confluent; pubescence sparse, very short, dark, recurved. Legs sparsely pubescent. Abdomen sparsely punctate and pubescent; apex of fifth sternite broadly emarginate. Length, 7 mm.

FEMALE.—Larger, more robust; antennae extending about four segments beyond body, segments clothed with long suberect hairs; elytra extending beyond apex of abdomen, pubescence long, erect; apex of fifth abdominal sternite deeply emarginate, V-shaped. Length, 12 mm.

Holotype male (American Museum of Natural History) from 8 MILES WEST MATACHIC, CHIHUAHUA, MEXICO, 7,200 feet, 8 July 1947 (D. Rockefeller Exped. Michener); allotype female from 2 miles west Matachic, 6,400 feet, 7 July 1947 (D. Rockefeller Exped. Cazier).

This species greatly resembles *M. bicolorata* Linsley but differs by having the eyes less widely separated on the vertex, the lobes of the eyes connected by a single row of facets, distinct elytral costae, and the dark underside and legs. The distinctive coloration of *violaceipennis* will distinguish it from the other known species of *Methia*.

¹ Support of the National Science Foundation through Grant G-19959 is gratefully acknowledged. Appreciation is also expressed to the following individuals and their respective institutions for the loan of material utilized in this study: G. Byers, University of Kansas; O. L. Cartwright, United States National Museum; J. T. Doyen, University of California, Berkeley; H. F. Howden, Canadian National Collection; A. T. McClay, University of California, Davis; and P. Vaurie, American Museum of Natural History.

Methia pulchra Chemsak and Linsley, new species

FEMALE.—Form slender, tapering apically; elytra fuscus with pale spots near middle and often at apex, head, prothorax, and underside except abdomen testaceous, often slightly infuscated, appendages testaceous to brownish, antennae with basal segments partially infuscated; integument finely, shallowly punctate, pubescence sparse. Head about as wide as pronotum; eyes subcontiguous on vertex, separated beneath by a distance greater than diameter of antennal scape, lobes connected by a single row of facets; antennae extending about three segments beyond body, scape with apical tooth absent, scape and third segment testaceous at apical half; suberect hairs abundant, longer internally. Pronotum broader than long, sides rounded, base strongly constricted and transversely impressed, apex weakly constricted, deeply impressed transversely; disk appearing impunctate, flattened; pubescence sparse, short, and subdepressed with few longer, suberect hairs interspersed; stridulatory plate of mesonotum not grooved. Elytra less than 2.5 times as long as broad, slightly tapering apically, extending to third abdominal segment; each elytron finely tricostate over basal half, the two interior costae uniting so that the surface is bicostate behind the middle, the costae evanescent apically; punctation fine, shallow, indistinct; pubescence short, pale, recurved, sparse, with a few longer, erect hairs interspersed. Legs usually bicolored, rather sparsely pubescent. Abdomen sparsely punctate and pubescent; apex of last sternite broadly V-shaped. Length, 6–8 mm.

MALE.—Antennae with short erect hairs densely placed along outside of segments; apex of last abdominal sternite rather shallowly emarginate. Length, 7 mm.

Holotype female, allotype male (United States National Museum) from CELARAIN POINT, COZUMEL ISLAND, QUINTANA ROO, MEXICO, 21 April 1960 (J. F. G. Clarke); one female paratype from Isla Mujeres, Quintana Roo, 29 March 1960 (J. F. G. Clarke).

This species is closely related to *M. constricticollis* Schaeffer and the West Indian *M. necydalea* (Fabricius). *M. pulchra* may be separated from *constricticollis* by the more strongly constricted pronotal base, stronger apical and basal transverse impressions of the pronotum, and the presence of some erect hairs on the elytra. From *necydalea*, *pulchra* differs by the impunctate, distinctly flattened pronotal disk, and the different color pattern.

METHIA OCCIDENTALIS Chemsak and Linsley

Methia occidentalis Chemsak and Linsley, 1964, Jour. New York Entomol. Soc., 72: 59.

Additional distributional records for this species as follows: 1 ♀, 16 miles southeast Empalme, Sonora, 7 May 1959 (Bechtel and Schlinger); 1 ♂, 3 miles north Hermosillo, Sonora, 25 May 1961 (Howden and Martin); 1 ♀ near San Jose Beach, 40 miles southwest Cd. Obregon, Sonora, 16–23 May 1961 (Howden and Martin), 1 ♀, 6 miles north–northwest Cd. Obregon, 2 June 1954 (A. A. Alcorn); 15 ♂ ♂, 1 ♀,

Arroyo Cuchujaqui, 10 miles southeast Alamos, Sonora, 20 June 1963 (J. T. Doyen) ; 11 ♂ ♂, ½ mile west Topolobampo, Sinaloa, 21 June 1963 (J. T. Doyen).

METHIA CONSTRICTICOLLIS Schaeffer

Methia constricticollis Schaeffer, 1908, Bull. Brooklyn Inst. Arts Sci., 1: 351; Linsley, 1962, Univ. California Publ. Entomol., 20: 31; Chemsak and Linsley, 1964, Jour. New York Entomol. Soc., 72: 57.

One ♂, 6 miles south Monterrey, Nuevo Leon, 25-28 August 1960 (H. Howden) ; 2 ♂ ♂, 5 miles south Monterrey, 3 September 1958 (H. Howden) ; 1 ♂, Cd. Mante, Tamaulipas, 27 July 1960 (H. Howden).

METHIA BREVIS Fall

Methia brevis Fall, 1929, Canadian Entomol., 61: 58; Linsley, 1934, Pan-Pac. Entomol., 10: 59; Linsley, 1942, Proc. California Acad. Sci., (4) 24: 29; Linsley, 1962, Univ. California Publ. Entomol., 20: 32; Chemsak and Linsley, 1964, Jour. New York Entomol. Soc., 72: 60.

Five ♂ ♂, San Felipe, Baja California, 15 June 1952 (M. Cazier, W. Gertsch, R. Schrammel).

METHIA PALLIDIPENNIS Linsley

Methia pallidipennis Linsley, 1942, Proc. California Acad. Sci., (4) 24: 32; Chemsak and Linsley, 1964, Jour. New York Entomol. Soc., 72: 58.

This species has previously been known only from the unique male type from San Domingo, Baja California. A female specimen from San Felipe, Baja California, 15 June 1952 (Cazier, Gertsch, Schrammel) appears to be assignable to *pallidipennis*. The specimen has pale, distinctly costate elytra, is about 11 mm long, and possesses the usual sexual differences from the male.

STYLOXUS LUCANUS LeConte

Styloxus lucanus LeConte, 1873, Smithsonian Misc. Coll., 11 (264): 240; Hamilton, 1885, Trans. Amer. Entomol. Soc., 23: 162; Linsley, 1940, Bull. Southern California Acad. Sci., 39: 45; Linsley, 1942, Proc. California Acad. Sci., (4) 24: 28; Chemsak and Linsley, 1964, Jour. New York Entomol. Soc., 72: 48.

Two ♂ ♂, 20 miles south Culiacan, Sonora, 22 June 1963 (J. T. Doyen) ; 1 ♂, 5 miles north Mazatlan, Sinaloa, 10 May 1961 (Howden and Martin).

STYLOXUS FUSCUS Chemsak and Linsley

Styloxus fuscus Chemsak and Linsley, 1964, Jour. New York Entomol. Soc., 72: 51.

Three ♂ ♂, 4 miles southwest Panuco, Veracruz, 10 June 1961 (Univ. Kansas Mexican Exped.).

STYLOXUS OBLATIPILIS Chemsak and Linsley

Styloxus oblatipilus Chemsak and Linsley, 1964, Jour. New York Entomol. Soc., 72:50.

Correction of a typographical error in Chemsak and Linsley (1964) from *oblatipilus* to *oblatipilis*.

***Coleomethia mexicana* Chemsak and Linsley, new species**

MALE.—Form short, stout; color shining black, pronotum with reddish areas at sides; pubescence long, erect, dense. Head narrower than pronotum, coarsely, deeply, confluent punctate on vertex, rims of punctures shining, front more finely, confluent punctate, surface opaque; pubescence moderately dense, dark, erect; eyes widely separated above and below, upper lobe small, lobes nearly divided, joined by a single row of facets; antennae extending about five joints beyond body, scape moderately coarsely, densely punctate, segments from second very densely clothed with erect dark hairs along outer margin, suberect hairs moderately dense internally. Pronotum broader than long, sides rounded, base moderately constricted, apex broader than base; disk very coarsely, deeply, contiguously punctate, punctures becoming finer at sides, dorsal calluses absent; pubescence dense, long, erect; stridulatory plate of mesonotum not grooved; prosternum finely transversely plicate, the ridges shining; episternum of metathorax finely, densely but separately punctured. Elytra less than $1\frac{1}{2}$ times as long as broad, not extending beyond metathorax, moderately dehiscent from base, sutural margins straight, apices rounded; punctation moderately coarse, dense, confluent at apical half; pubescence sparse, short, erect; each elytron with vague paler sutural spots behind the scutellum; wings dark. Legs slender; hind tibiae stout, arcuate at apical one-third, very densely clothed with long suberect, dark hairs which give the appearance of a scopa. Abdomen short; apex of last sternite emarginate. Length, 7 mm.

Holotype male (University of Kansas) from 4 MILES WEST OF PACHUCA, HIDALGO, MEXICO, 16 June 1961, 7,900 feet (Univ. Kansas Mexican Exped.).

This species differs from *C. evaniformis* (Knull) (1937) by the less dehiscent elytra, nonarcuate sutural margins of the elytra, dark wings, finely punctate episternum of the metathorax, and more densely pubescent, arcuate hind tibiae.

The genus *Coleomethia* Linsley (1940) was not included in the treatment of the Methiini of Mexico and Central America (Chemsak and Linsley, 1964) because it was not known from south of Texas at that time. Although *Coleomethia* closely resembles *Methia*, it differs by the shorter elytra, very widely separated eyes, more widely separated eye lobes, abbreviated abdomen, and possession of the dense scopa-like hairs of the posterior tibiae.

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Distributional Notes on *Septis maxima* with Illustrations of the Genitalia

(Lepidoptera : Noctuidae)

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In 1904, Harrison G. Dyar described *Polia maxima* from a male specimen collected on 2 May in Eureka, Humboldt County, California (H. S. Barber). It was first placed in *Polia* by Dyar because of its superficial resemblance to *Polia acera* Smith. Both *P. acera* and *P. maxima* were assigned to *Andropolia* Grote by Hampson (1909), thus placing them in a different subfamily. Later authors, following McDunnough (1938), placed *A. maxima* in the genus *Septis* Hübner.

S. maxima, so far as known, is endemic to coastal areas where the larvae feed on stout grasses such as the Pacific reed grass, *Calamagrostis nutkaensis* Presl (Crumb, 1956). The Pacific reed grass inhabits the coastal swampy areas and moist wooded hills extending from Monterey County, California, northward into Alaska. *S. maxima* probably occurs over much the same range as does one of its known food plants, *C. nutkaensis*.

Crumb (1956) states: "The larvae feed several inches below the surface of the sand. In grasses with large, hard stems . . . the larvae bore a hole to the heart of the stem tunneling this for a short distance without remaining permanently in the burrow." The larvae are about 37 mm in length and 6 mm wide at the middle (Crumb, 1956). These measurements are of live specimens, and inflated or injected specimens could be larger.

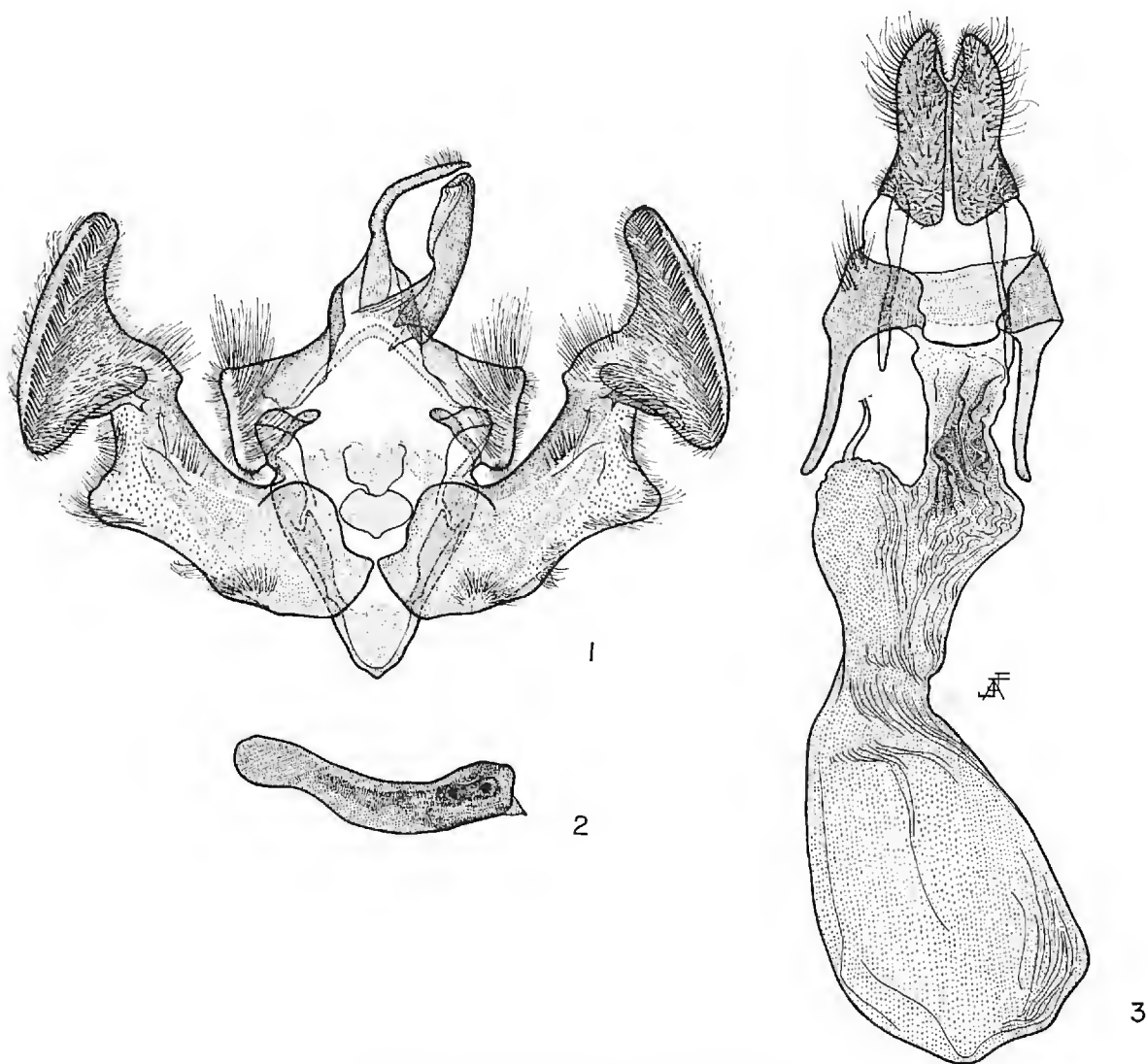
Adult *S. maxima* vary slightly in alar expanse, and average about 26 mm for over 200 specimens examined. The primaries are light ochreous, washed with lilac, especially in the subterminal space and along the inner margin. The ordinary cross lines are much darker than the ground color, a basal dash and a corresponding parallel dash just below the basal dash on the inner margin being, perhaps, the most prominent lines; reniform, obicular, and claviform large, outlined in black. The ventral surface of the primaries is smoky from base to subterminal line, thence becoming lighter to fringes. The secondaries are smoky brown, the veins darker. Ventral surface of secondaries very pale brown, considerably lighter in color than the basal area of the primaries.

In 1962, a large series of *S. maxima* was collected during July and the first part of August at Dillon Beach, Marin County, California (M. G.

Tunzi). Until this time *S. maxima* was considered an uncommon species and was rare in collections. The southern record is represented by a single male collected in Monterey County, California in July (W. H. Lange) and the northern record was Victoria, British Columbia, Canada (Blackmore, 1927).

As the genitalia of *S. maxima* has, to my knowledge, never been illustrated for either sex, I figure them in this paper. The adult has been adequately figured previously in Hampson (1909).

The majority of the specimens examined are in the Bauer-Buckett collection, Davis, California, and a series is in the Entomology Collection, University of California, Davis. The illustrations were prepared by Miss Judith Jay, departmental artist, Entomology Department, University of California, Davis.



EXPLANATION OF FIGURES

Figs. 1-3, genitalic structures of *Septis maxima* (Dyar). 1, male genitalia minus aedeagus; Dillon Beach, Marin County, California, 6 July 1962 (M. G. Tunzi), Bauer-Buckett slide number 63C11-30. 2, aedeagus of male genitalia. 3, female genitalia of *maxima*; Dillon Beach, Marin County, California, 12 July 1962 (M. G. Tunzi), Bauer-Buckett slide number 63C11-31.

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ZOOLOGICAL NOMENCLATURE: Notice of proposed use of plenary powers in certain cases (A. [n.s.] 63).

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full details of which will be found in *Bulletin of Zoological Nomenclature*, Vol. 21, Part 2, published 23 April 1964.

- (7) Validation of the specific name *Griselda radicana* Heinrich, 1923 (Insecta, Lepidoptera). Z.N.(S.) 1612;
- (8) Designation of a type-species for *Baetis* (Leach, 1815) (Insecta, Ephemeroptera). Z.N.(S.) 1620;
- (9) Designation of a type-species for *Megalopta* Smith, 1853 (Insecta, Hymenoptera). Z.N.(S.) 1624;
- (10) Suppression of *Amaurobius* C. L. Koch, 1836, and *Cavator* Blackwell, 1840 (Araneae). Z.N.(S.) 1625;
- (11) Validation of the family-group name PLATYPLEURINAE Schmidt, 1918 (Insecta, Hemiptera). Z.N.(S.) 1626.

Any zoologist who wishes to comment on the above cases should do so in writing, and in duplicate, as soon as possible, and in any case before 23 October 1964. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 23 October 1964, be brought to the attention of the Commission at the time of commencement of voting.

All communications on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S. W. 7, England.—W. E. CHINA, *Acting Secretary to the International Commission on Zoological Nomenclature*.

Descriptions of Three New Species and New Distribution Records of California Bark Beetles¹

(Coleoptera : Scolytidae)

DONALD E. BRIGHT, JR.

University of California, Berkeley

Studies on the Scolytidae of California have been under way for several years at the University of California and for the past few years collecting has been concentrated on the more rare coniferous trees. In the course of this study, several species new to the California fauna and three species new to science were discovered. The new species represent the genera *Carphoborus* Eichhoff, *Pityophthorus* Eichhoff, and *Scolytus* Geoffroy.

***Carphoborus tuberculatus* Bright, new species**

This species is closely allied to *Carphoborus pinicolens* Wood (1954) but differs by the presence of a tubercle on the frons of the female (occasionally reduced or even lacking), by the much smaller glabrous area on the female frons, by the more prominent tubercles on the first, third, and ninth declivital interspaces, and by its host.

FEMALE.—Length 2.4 mm (paratypes 2.00–2.50 mm), 2.4 times longer than wide.

Frons slightly convex, with the epistomal margin slightly elevated, produced and glabrous in median portion; surface shining, deeply and distinctly punctured except for a small impunctate circular portion with a blunt median tubercle (variable) and a low inconspicuous carina between the tubercle and the epistomal margin; pubescence on frons rather fine, long and incurved. Antennal club as long as wide, sutures arched; otherwise resembling *pinicolens*.

Pronotum 1.3 times longer than wide; sides sinuate, constricted posteriorly to the broadly rounded anterior margin, also constricted at posterior one-fourth; surface reticulate, shining; punctures separate and distinct; median line impunctate and slightly elevated; vestiture consisting of short, broad, scale-like setae.

Elytra 1.8 times longer than wide; sides parallel, broadly rounded behind; basal margins margined with blunt overlapping crenulations; striae distinctly impressed, punctures large and deep; interstriae about twice as wide as striae. Declivity as in *pinicolens* except interspaces one and three more strongly elevated and armed with larger tubercles; second interspace depressed and continuing to elytral apex; third and ninth interspace joined. Vestiture consisting of broad, short, yellowish, scale-like setae.

MALE.—Similar to female except frons strongly transversely impressed above

¹ Study performed with partial support from the California State Division of Forestry, T. B. Walker Foundation, Surdna Foundation, and various forest industries. Research conducted under California Experiment Station Project No. 1778, "The classification, bionomics, ecology and control of bark beetles infesting California trees."

epistomal margin, convex above; median tubercule, which is characteristic of males in this genus, prominent; vestiture much shorter and sparser but covering entire frons; first and third declivital interspaces less strongly elevated and with smaller, sparser tubercules.

TYPE LOCALITY.—CROOKED CREEK, WHITE MOUNTAINS, MONO COUNTY, CALIFORNIA, 3 AIRLINE MILES NORTH OF THE INYO COUNTY LINE.

HOST.—*Pinus aristata* Engelm.

TYPE MATERIAL.—The *female holotype*, allotype, and 55 paratypes were collected at the type locality on 4 July 1961 by J. A. Powell (No. 61G5), and emerged from rearing on 24 December 1961 in Berkeley, California.

The holotype, allotype, and six paratypes are deposited in the collection of the California Academy of Sciences, San Francisco. Additional paratypes are deposited in the collection of the United States National Museum, Washington, D. C., the collection of S. L. Wood (Brigham Young University, Provo, Utah), the California Insect Survey collection (University of California, Berkeley), and in the collection of the author.

This species is the only known North American species with a tubercle in the glabrous portion of the female frons. It can be recognized easily by this character which is present in about 77% of the females. In its absence the declivital characters distinguish this species.

***Pityophthorus aristatae* Bright, new species**

This is apparently the first scolytid species to be described from the bristlecone pine, *Pinus aristata* Engelm. It appears to be related to the caelator-dentifrons group, but can be distinguished from these species by the concave frons of the female (less concave than *Pityophthorus carmeli*), by the large frontal tooth of the male, by the smaller size of both sexes, and by its distribution.

FEMALE.—Length 2.01 mm (paratypes 1.75–2.25 mm), 2.68 times longer than wide.

Frons shining, flattened from eye to eye, moderately concave at center, sparsely and finely punctured; clothed with fine, long hairs (abraded in holotype), longer, incurved, and more abundant above; sides more roughly and closely punctured. Antenna light brown, club about twice as long as funicle, 1.33 times longer than wide, widest through second segment, first and third sutures weakly arcuate.

Pronotum slightly longer than wide, posterior margin somewhat narrowly rounded; sides arcuate; anterior margin distinctly serrate, median four serrations longer and more prominent; anterior portion moderately asperate with irregularly broken concentric rows; summit moderately high with a posterior transverse impression; posterior discal area shining with close, deep punctures, median line impunctate and slightly elevated.

Elytra as wide as pronotum, 1.55 times longer than wide, sides parallel and broadly rounded behind; striae punctures impressed in nearly regular rows, small and not close, each armed with a short, yellowish seta; interspaces finely reticulate with a few scattered punctures, each armed with a longer seta. Declivity rounded, slightly

sulcate, and brightly shining; sutural interspace elevated and with small granules; second interspace widened, depressed, and flattened; lateral elevations low, with several small granules.

MALE.—Similar in size to female; frons shining and flattened with a distinct longitudinal, laterally compressed median carina; pronotal and elytral characters similar to female.

TYPE LOCALITY.—CROOKED CREEK, WHITE MOUNTAINS, MONO COUNTY, CALIFORNIA, 3 AIRLINE MILES NORTH OF INYO COUNTY LINE.

HOST.—Bristlecone pine, *Pinus aristata* Engelmann.

TYPE MATERIAL.—The *female holotype*, allotype, and eight paratypes were collected from dying branches by J. A. Powell (No. 61G5) on 4 July 1961 and emerged from rearing on 12 April 1962, 24 December 1962, and 1 September 1963 in Berkeley, California.

The holotype and allotype are deposited in the collection of the California Academy of Sciences, San Francisco, with additional paratypes in the collections of the California Insect Survey, University of California, Berkeley, and the author.

***Scolytus dentatus* Bright, new species**

This species is one of the largest of North American *Scolytus*, being equaled or exceeded in size only by *Scolytus subscaber* LeConte. It can be easily recognized by the prominent tooth on the posterior margin of the fourth sternite of the male and by the larger size of both sexes.

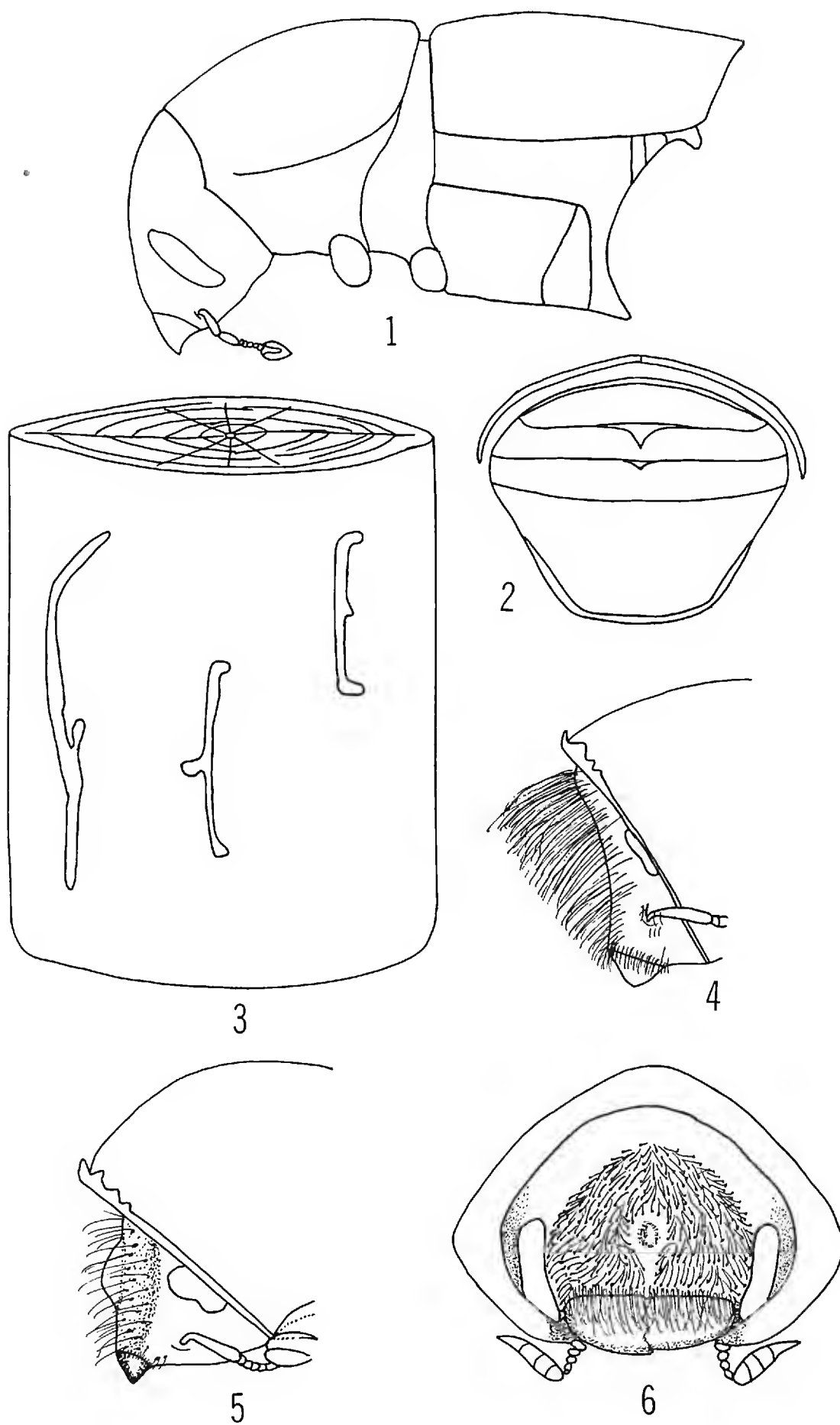
MALE.—Length from anterior margin of pronotum to posterior margin of elytra, 3.9 mm (paratypes 3.30–4.35 mm); about twice as long as wide.

Frons flattened from eye to eye, shining black, closely, finely aciculate with a smooth, shining median line extending from the epistomal margin to the vertex; pubescence consisting of sparsely placed erect yellow hair. Epistomal process not reaching epistomal margin, strongly produced at lateral margins, bordered anteriorly by a brush of stout yellowish hairs. Eye elongate, wider above, anterior margin broadly and shallowly emarginate. Antenna reddish brown, club 1.53 times longer than wide, sutures strongly angulate.

Pronotum 1.21 times wider than long, widest just behind middle; anterior margin broadly rounded; posterior margin slightly sinuate with a fine raised line; surface smooth and brightly shining, punctures small, widely spaced, becoming larger toward the prominently raised lateral line.

Elytra 1.43 times longer than wide, sides slightly arcuate; broadly rounded behind; posterior margin slightly serrate; surface reddish, shining, scabrous at the base; striae punctures fine, distinctly impressed in regular rows on disk, becoming larger and confused in lateral portions and near apex.

Venter of abdomen with first sternite horizontal, punctures indistinct, clothed with yellowish setae; second sternite vertical, deeply concave with the anterior margin strongly produced, surface dull, indistinctly punctured, and minutely reticulate, posterior margin with a blunt, median tubercle; third sternite more finely, obscurely punctured, posterior margin slightly thickened in median portion; fourth sternite as wide as third, indistinctly punctured, posterior margin with a prominent, sharp



median tooth; fifth sternite wider than third or fourth, slightly more distinctly punctured, concave, with a strongly elevated, arcuate posterior margin.

FEMALE.—Similar to male in general outline but differs in that the frons is strongly convex, the anterior margin of second sternite is much less strongly extended, and the second and fourth abdominal sternites are devoid of teeth.

TYPE LOCALITY.—CONE PEAK, MONTEREY COUNTY, CALIFORNIA.

HOST.—Bristlecone fir, *Abies bracteata* D. Don.

TYPE MATERIAL.—The *male holotype*, allotype, and 120 paratypes were collected by Clayton J. Wray² on 29 June 1963. Thirteen additional paratypes were collected 15 miles south of Carmel Valley, Monterey County, California on 22 June 1963 by Wray.

The holotype, allotype, and ten paratypes are deposited in the collection of the California Academy of Sciences, San Francisco and additional paratypes are in the collections of: S. L. Wood, Brigham Young University, Provo, Utah; University of Michigan, Ann Arbor; Duke University, Durham, North Carolina; United States National Museum, Washington, D. C.; California Insect Survey, University of California, Berkeley; and the author.

This species was collected from the trunk and larger limbs of a standing bristlecone fir. The vertically oriented parent galleries deeply engraved the sapwood and the gallery system is comprised of two egg tunnels each terminating with a pronounced hook (Fig. 3). Egg niches are closely spaced on both sides of the gallery and packed with frass. The total length varied from 50 mm to 120 mm.

NEW LOCALITY RECORDS

The following species, not previously known to occur in California, have recently been collected. Several significant extensions of range are included here. With the exception of *Ips amiskwensis* G. Hopping, all determinations were made by the author.

Alniphagus hirsutus Schedl. Cliff Lake, Siskiyou County, 24 August 1959. Host: *Alnus tenuifolia* Nuttall. W. D. Bedard, collector.

² Professor, Department of Forestry, Michigan College of Mining and Technology, Sault Ste. Marie, Michigan. Supported by National Science Foundation, Research Participation Program for College Teachers, 1963.

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EXPLANATION OF FIGURES

Fig. 1, lateral aspect of the male of *Scolytus dentatus* Bright. Fig. 2, anterior view of venter of abdomen in male *Scolytus dentatus* Bright. Fig. 3, parent galleries of *Scolytus dentatus* Bright. Fig. 4, view in profile of head of female *Pityophthorus aristatae* Bright. Fig. 5, view in profile of head of male of *Pityophthorus aristatae* Bright. Fig. 6, frontal view of female frons of *Carphoborus tuberculatus* Bright.

- Carphoborus intermedius* Wood. Thirteen miles north of Happy Camp, Siskiyou County, 13 August 1963. Host: *Picea breweriana* S. Wats. C. J. Wray, collector.
- Conophthorus flexilis* Hopkins. Crooked Creek, White Mountains, Mono County, 23 June 1961. Host: Cones of *Pinus flexilis* James. J. A. Powell, collector.
- Ips amiskwensis* G. Hopping. Horse Range Creek, 7 miles northwest of Callahan, Siskiyou County, 16 June 1963. Host: *Picea engelmanni* Parry. D. E. Bright and C. J. Wray, collectors.
- Pityophthorus modicus* Blackman. Sandstone Camp, 3 miles south of Pine Mountain Summit, Ventura County, 15 April 1962 and Wrightwood, San Bernardino County, 19 April 1962. Host: *Pinus monophylla* Torrey and Fremont. D. E. Bright and B. A. Barr, collectors.
- Scierus annectans* LeConte. Horse Range Creek, 7 miles northeast of Callahan, Siskiyou County, 16 June 1963. Host: *Picea engelmanni* Parry. D. E. Bright and C. J. Wray, collectors.
- Scolytus picea* Swaine. Horse Range Creek, 7 miles northwest of Callahan, Siskiyou County, 16 June 1963. Host: *Picea engelmanni* Parry. D. E. Bright and C. J. Wray, collectors. Thirteen miles north of Happy Camp, Siskiyou County, 31 July 1963. Host: *Picea breweriana* S. Wats. C. J. Wray, collector.
- Xylechinus montanus* Blackman. Horse Range Creek, 7 miles northwest of Callahan, Siskiyou County, 16 June 1963. Host: *Picea engelmanni* Parry. D. E. Bright and C. J. Wray, collectors.

ACKNOWLEDGMENTS

The author wishes to express his sincere appreciation to Drs. E. G. Linsley, R. W. Stark, and D. L. Wood for their efforts in reading and criticizing the manuscript. Thanks are also given to Mr. G. R. Hopping for identifying the *Ips amiskwensis* and to C. J. Wray for his collecting efforts. Appreciation is also given to Mr. H. B. Leech of the California Academy of Sciences, San Francisco, California, and Dr. J. A. Powell of the California Insect Survey, University of California, Berkeley, for making their collections available for study.

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Trapping Male *Pleocomma* with Black Light

(Coleoptera : Scarabaeidae)

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Hood River, Oregon*

The first record of *Pleocomma* being attracted to black light was that of Fisher (1961), who reported trapping 183 males of *Pleocomma dubitalis dubitalis* Davis, near Salem, Oregon. Ellertson and Ritcher (1959) stated that males of *P. crinita* Linsley, *P. minor* Linsley, and *P. oregonensis* Leach were not attracted to light from a gasoline lantern, kerosene light, or automobile headlights. They stated, however, that two specimens of *P. crinita* and a number of males of *P. minor* had been collected at lighted windows.

In the fall months of 1961, 1962, and 1963, numerous attempts were made in Hood River and Wasco Counties, Oregon, to determine if the rain beetles occurring there were attracted to black light, using a G. E. F15T8/BL tube suspended vertically in a baffle over a funnel trap and powered by a portable gasoline-driven generator. Results of this work, omitting times when no beetles were caught, are given in Table 1.

Males of *P. minor* and *P. crinita*, both occurring in the Hood River Valley (Hood River County), and of *P. oregonensis*, occurring at The Dalles (Wasco County), were attracted to black light, in the early morning hours while it was still dark. Trap catches were the largest when there was a heavy flight observed such as occurred on 1 and 8 November 1962 with *P. oregonensis*. A few beetles of all three species were taken in the black light traps even when flight was not observed on the site, by the use of flashlights and car headlights.

In some cases, periodic examination was made of the ground in the immediate vicinity of the light trap after flight began. For example, on 27 October 1961, on a *P. minor* site, an occasional male was seen on the ground under the trap with metathoracic wings unfolded and elytra raised, indicating they had flown there. These males again took flight and flew directly against the black light tube, or hovered near the tube, hit the baffles, and dropped through the cone into the killing jar below. Other males flew directly to the light, hitting the baffles while maneuvering near the light tube.

Males of *P. oregonensis* behaved in rather similar fashion. On 1 November 1961, one black light trap was in operation at the time of a heavy flight

¹ This paper was prepared from the notes of the late Floyd Ellertson by Paul Ritcher, his friend and colleague. The assistance of Forrest Peifer is gratefully acknowledged.

Table 1. Male *Pleocomma* trapped at 15-watt black light in two Oregon counties.

Species	Date	Place	Time	No. Traps	Males Caught	Flight
<i>P. minor</i>	27 October 1961	Dee	5:30–6:30 a.m.	1	17	some
"	24 October 1963	Oak Grove ¹	5:35–7:15 a.m.	2	4	none observed
<i>P. crinita</i>	11 November 1961	Oak Grove	5:45–6:15 a.m.	1	3	none observed
"	1 December 1961	Oak Grove	6:00–6:15 a.m.	2	2	none observed
"	2 December 1961	Oak Grove	6:15–6:30 a.m.	2	1	none observed
"	4 December 1961	Oak Grove	6:00–7:00 a.m.	2	10	
<i>P. oregonensis</i>	28 October 1961	The Dalles	5:10–6:25 a.m.	1	1	none observed
"	1 November 1962	The Dalles	5:10–6:20 a.m.	1	78	heavy
"	6 November 1962	The Dalles	5:30–6:05 a.m.	1	3	none observed
"	8 November 1962	The Dalles	5:20–6:25 a.m.	1	41	heavy
"	9 November 1962	The Dalles	5:28–6:35 a.m.	1	12	moderate

¹ This is a different site from that where *P. crinita* was collected.

in Sorosis Park, at The Dalles (see Table 1). Males flew directly to the light, or flew against the lower part of the trap, fell to the soil surface, then took flight again and flew into the trap. Others alighted on the soil surface at distances of from 7 feet away to just under the trap. At one time 16 males with metathoracic wings extended were captured on the soil surface and are not included in the total catch of 78 beetles.

On several occasions two black light traps were used, one placed low on the ground (tube 2 to 3.5 feet above the ground) and one placed high (tube 3 to 4.5 feet above the ground). Unfortunately, at all of these times there was only a small flight and results were inconclusive. On 4 December 1961, on a *P. crinita* site, five males were collected in each of the two traps. On 24 October 1963, on a *P. minor* site, four males were collected in the low trap and none in the high trap.

On 6 November 1962, attractiveness of black light and red light (F 15 T8/RL) was compared in two traps placed 200 feet apart on a *P. oregonensis* site. Three males were caught in the black light trap and none at the red light. Again on 8 November 1962, a similar comparison was made during a heavy flight and trap position switched while the flight was in progress. Although 41 males were captured in the black light trap, not a single male entered the red trap.

On 9 November 1962, a black light trap and a green light trap (F 15 T8/GL) were compared on the same *P. oregonensis* site during a smaller flight. Twelve males were captured in the black light trap and 10 males in the green light trap.

In summary, males of three species of rain beetles, *P. minor* Linsley, *P. crinita* Linsley, and *P. oregonensis* Leach, were attracted to black light. Red fluorescent light was tried on a *P. oregonensis* site, but was unattractive. Based on one test only, green fluorescent light was equally as attractive as black light to *P. oregonensis*.

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Notes on the Biology and Larval Morphology of *Xenoglossa strenua*

(Hymenoptera : Apoidea)

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Xenoglossa strenua (Cresson) (Fig. 1) is tawny in color and slightly larger than the honey bee. It ranges across the United States at low elevations. Its pollen collecting is limited to the genus *Cucurbita* of which the cultivated pumpkins and squashes, *Cucurbita pepo* L. and *C. maxima* Duchesne, are usually the only representatives present. Although abundant on squash and pumpkin patches in many states, it is seldom observed or collected because of its matinal flight period (Cockerell, 1896). Other species of the genus also visit *Cucurbita* and have similar flight periods (Linsley, MacSwain, and Smith, 1955). The following observations were made in a squash patch at the Agricultural Research Center at Beltsville, Maryland.

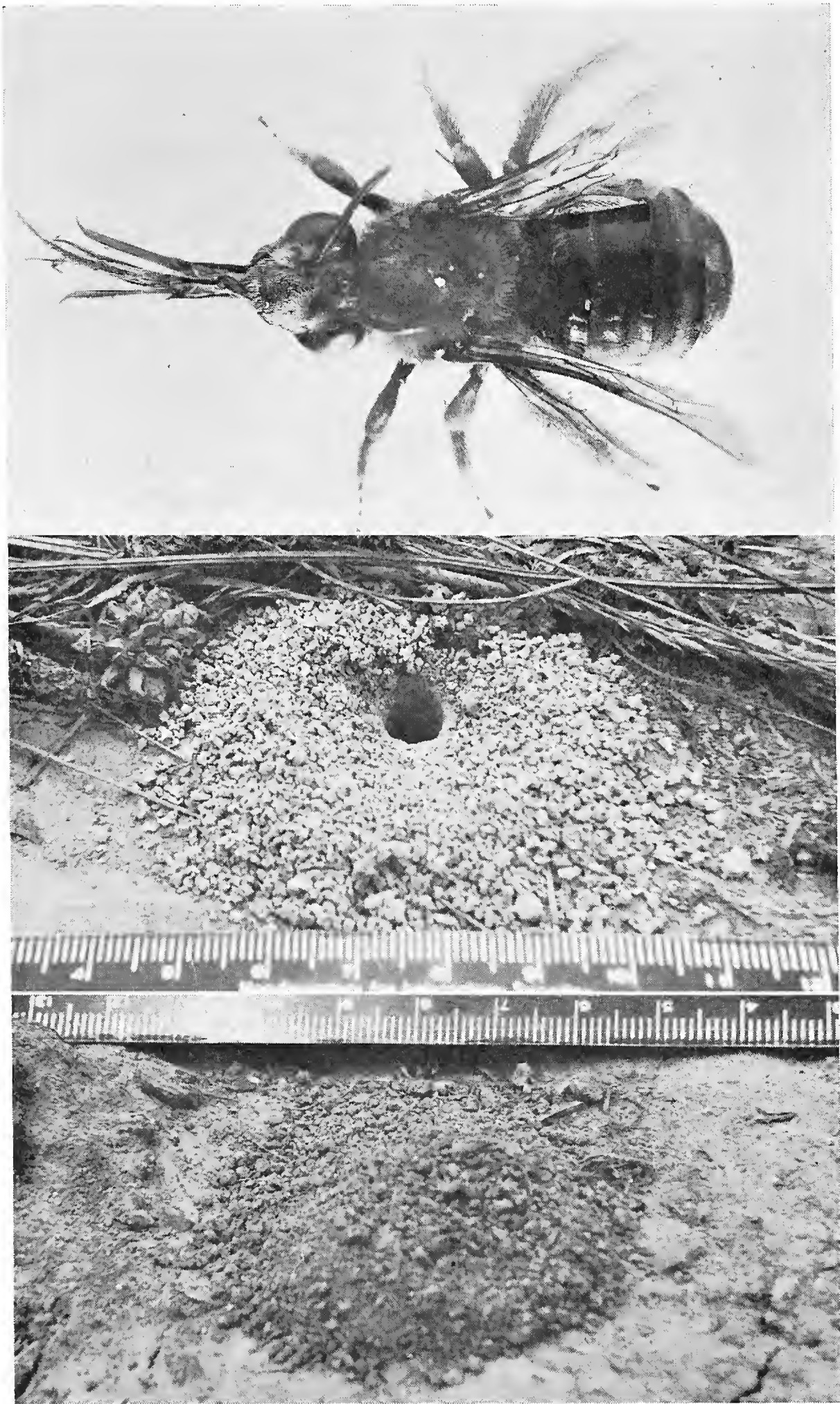
During August 1957, when the following observations were made, *Xenoglossa strenua* was visiting squash and pumpkin flowers in company with *Peponapis pruinosa pruinosa* (Say), a slightly smaller bee in the same tribe, which is also restricted to *Cucurbita*. Both sexes of *Xenoglossa strenua* were present on the flowers at 6 a.m., the earliest time observations were made. The early rays of the sun were beginning to shine through some pine trees and the temperature was recorded at 72° F. The female bees worked very rapidly, visiting both sexes of squash flowers, but usually going to a female flower only after several consecutive trips to male flowers. They sometimes visited the male flowers exclusively for pollen but occasionally tarried to probe them for nectar as well. Usually they scraped pollen from the stamens only, but some individuals also tried with some success to collect pollen that had been knocked to the base of the anthers by previous visitors. Males visited both flower sexes for nectar indiscriminately.

By 7:30 a.m., when the sun was above the trees, the females were scarce although males and both sexes of *Peponapis pruinosa* were still flying.

EXPLANATION OF FIGURES

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Fig. 1 (upper). Adult female. Fig. 2 (middle). Nest entrance and tumulus. Fig. 3 (lower). Nest entrance closed for the night.



By 8 a.m. both sexes of *Xenoglossa strenua* were gone and female *Peponapis pruinosa* were disappearing. By 9 a.m. only honey bees, and a few other bees that were not host specific, such as *Agapostemon radiatus* (Say) and *Halictus ligatus* (Say), could still be found.

Some nests were found at the edge of the squash vines or several yards away from them. They were in flat, bare ground or against a small drift line of pine needles and other litter (Fig. 2). These sites were in contrast to those of the nests of *Xenoglossa fulva* Smith, which Linsley, MacSwain, and Smith (1955) found nesting in dense, close-cropped grass in Mexico. The tumulus of *Xenoglossa strenua* was in the form of a symmetrical cone, about 1½ cm high, 6 to 7 cm across at the base, and 2½ cm across at the summit. The conical crater was about one-third as deep as the tumulus. When the nest was open, the burrow entrance was seen to be sharply defined and smoothly walled. When the tumulus was blown away, the entrance remained as a chimney about 1 cm high. The burrow was 7 mm in diameter and not constricted toward the entrance.

The bees left their burrows open while foraging but closed them a few millimeters below the surface when they returned from the field for the last time in the morning. During the night they pushed more soil into the entrance, closing the crater (Fig. 3).

In three nests that were excavated completely, the main burrow followed a steep, gradually spiralling course. The depth of the uppermost cell ranged from 22 to 26 cm. Several cells were usually found at almost the same depth, about 3 cm from the main burrow and forming a roughly triangular or quadrangular pattern. The branch burrows slanted at a 30° to 45° angle from horizontal and were completely plugged with earth. The cells, 18 mm long by 10 mm wide, were vertical or nearly so and had a spiral ceiling where the slanting burrow joined the vertical cell. Their walls had a distinct waterproof coating, more pronounced toward the bottom of the cell but still visible near the ceiling. Their form is shown in Fig. 15 and the coating in Fig. 5. The cell walls were composed of uniform, fine materials, showing that they were applied to a previously excavated cavity. However, the walls graded almost imperceptibly into the surrounding soil and the cells were very fragile.

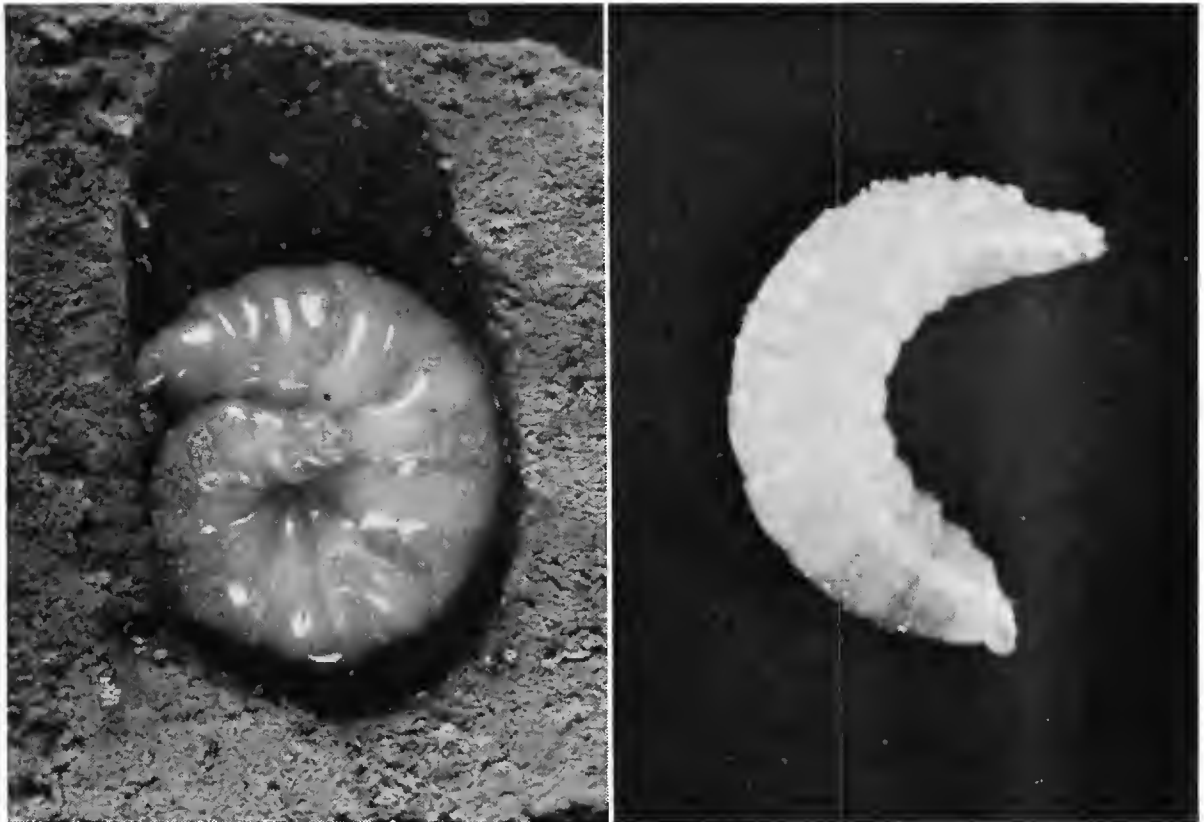
Beyond the first group of cells the main burrow was almost horizontal.

EXPLANATION OF FIGURES

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Fig. 4 (upper). Provisions with dry "crumbs" on top (egg damaged). Fig. 5 (lower left). Egg on provisions after moistening and consolidation of crumbs. Fig. 6. (lower right). Third instar larva in horizontal position.





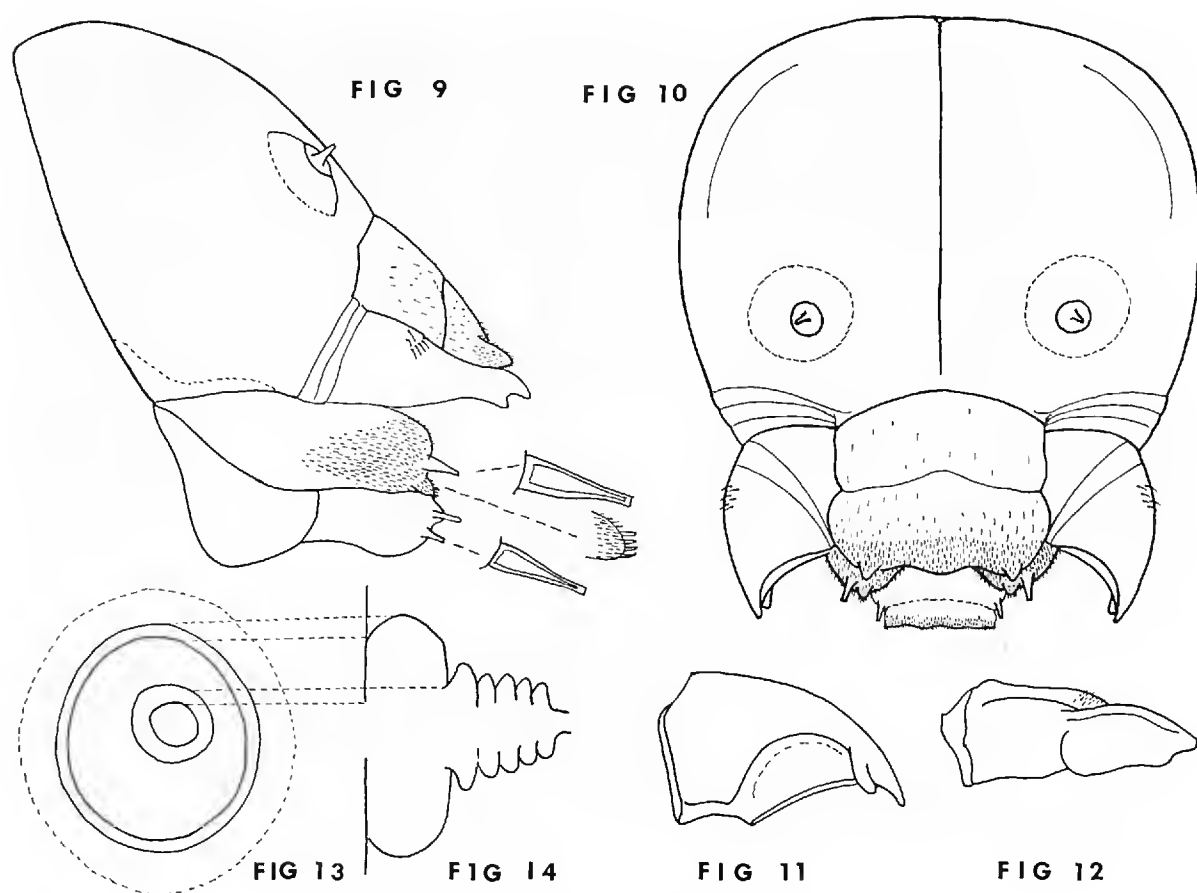
EXPLANATION OF FIGURES

Fig. 7 (left). Full-grown larva ready to deposit feces. Fig. 8 (right). Full-grown larva showing extended prothorax and divided caudal segment.

In one nest the second group consisted of three cells 8 cm from the first group and only 4 cm deeper. They were only 2 cm apart and on the same level. Another cell was 12 cm in back of the second group and 2 cm deeper. Still another group of three cells was 8 cm in front of the second group. Finally, another group of three cells was only slightly deeper and about 9 cm away. The nest had 13 cells in all and the bee was still provisioning one of the cells in the uppermost group. Beyond the uppermost group the main burrow was almost completely plugged. Plugging indicated a general progression in cell building from the end of the main burrow backward toward the entrance. However, development of the larvae in the various cells indicated that the third group from the entrance was prepared and provisioned before the fourth group. This nest is illustrated by Fig. 17.

In another nest the main burrow tended to follow a horizontal, circular course after it passed the first group of cells so that the farthest point became, in fact, closer to the first group of cells than some of the others. This nest had nine cells and was still under construction.

The *Xenoglossa strenua* nests observed resembled those of *X. fulva* reported by Linsley, MacSwain, and Smith (1955) in the symmetrical



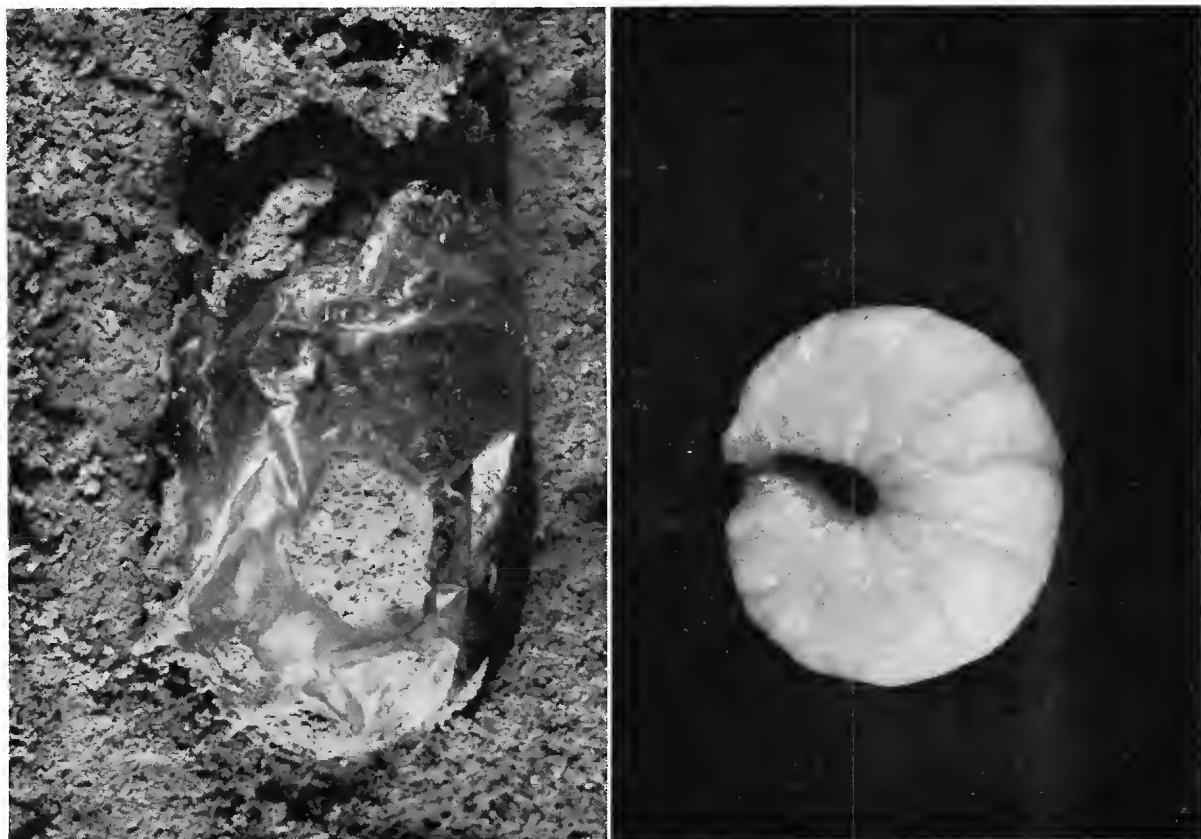
EXPLANATION OF FIGURES

Fig. 9. Head capsule of fourth instar larva (lateral view). Fig. 10. Head capsule of fourth instar larva (anterior view). Fig. 11. Mandible of fourth instar larva (ventral view). Fig. 12. Mandible of fourth instar larva (inner view). Fig. 13. Spiracle of fourth instar larva (surface view). Fig. 14. Spiracle, atrium, and subatrium of fourth instar larva (longitudinal section).

mound, spiral main burrow, and short branches leading in random directions to individual, vertical cells that lack an outer wall. They differ in being less than half as deep. The cells also differed in having the walls of the upper three-fourths gradually converging above.

The provisions, packed into the bottom third of the cells, were composed of a jellylike mass of pollen and nectar surmounted by a partial layer of "crumbs" composed of loosely adhering pollen masses (Fig. 4). Before the eggs hatched these crumbs usually consolidated with the moist mass below (Fig. 5). The absence of a definite layer of liquid on top of the pollen contrasted with the presence of such a layer in the cells of *X. fulva* (Linsley, MacSwain, and Smith, 1955).

The eggs, measuring $4\frac{1}{2}$ by 1 mm, were attached at both ends to the pollen and arched away from it at the middle (Fig. 5). The anterior end was slightly larger and almost imperceptibly flattened at the point of contact.



EXPLANATION OF FIGURES

Fig. 15 (left). Cocoon in cell showing fecal pellets under ceiling. Fig. 16 (right). Prepupa in normal upside-down, C-shaped position.

The larvae fed on top of the pollen mass and in a horizontal and nearly straight position until they reached the last instar (Fig. 6), after which they fed downward and finally curled around the remaining pollen mass in a vertical plane. Fecal pellets were not deposited until the food was consumed and a few threads of silk had been spun a few millimeters below the ceiling. At this time the full-grown larva assumed the upside-down position shown in Fig. 7, raising and extending its anterior segments when spinning silk for the upper part of the cocoon and extending its posterior end when depositing feces. Before depositing feces the larva was smooth and shining, somewhat turgid, and capable of quick movements. The head capsule was depressed in relation to the thoracic segments and more prognathous than most bee larvae (Figs. 7 and 8). The posterior half of the terminal abdominal segment was small, conical, and quite distinct from the anterior half (Fig. 8). The creamy fat bodies in the thorax and abdomen showed clearly through the transparent skin (Fig. 7).

The head capsule of the fourth instar larva (Figs. 9, 10, 11, 12) was similar to that of *Melissodes* sp., figured by Michener (1953). It differed in having a smoother frontoclypeal profile, apically truncate palpi, a ventral tubercle below the maxillary palpus with modified setae, and in

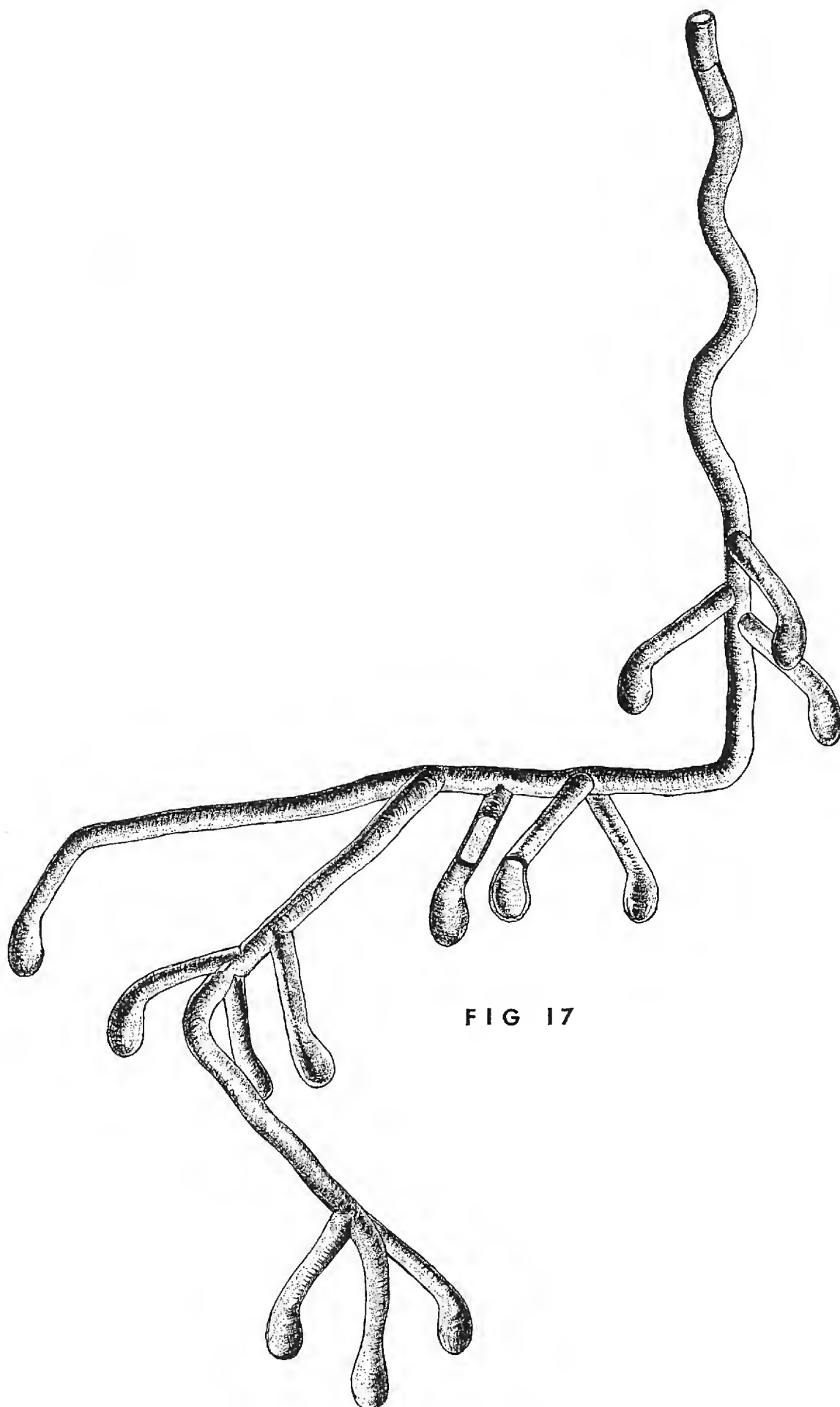


FIG 17

EXPLANATION OF FIGURE

Fig. 17. Sketch of complete nest described in text.

details of the mandibular teeth and cusp. The six setae on the dorsal surface of the mandibles may be specific.

The spiracles (Figs. 12 and 13) were exceptionally transparent and flush with the body wall. They resembled those of *Melissodes* sp. (Michener, 1953) but lacked teeth in the atrium. At least 5 bellowslike convolutions were seen in the subatrium of the specimens examined.

The early stages of cocoon spinning took place simultaneously with fecal deposition. Most of the fecal pellets became incorporated in the ceiling of the cocoon or were pushed above it against the ceiling of the cell or its upper walls (Fig. 15).

The finished cocoon was translucent and yellowish with a texture like thin parchment. It conformed to the shape of the cell walls and adhered loosely to them, except at the top where it ended 2 or 3 mm below the cell ceiling. The cocoon had a conical cap composed of up to seven loosely arranged layers consisting of parchmentlike silk reinforced by a network of coarse, reddish strands. At the base of this cap was a gently domed floor of similar material which formed the ceiling of the cocoon cavity. At the level of this ceiling a distinct upward-directed flange of silk was attached to the outer wall of the cocoon. The cocoon walls below the flange lacked distinct fibers and seemed to have only one layer, but close examination revealed at least two closely adhering layers in most areas. When teased apart, the wall was seen to have numerous fine, pale fibers in an apparently nonfibrous matrix. In the space above the cocoon a number of coarse strands of silk crisscrossed and fastened it to the cell ceiling (Fig. 15).

In its cocoon structure *Xenoglossa strenua* clearly showed its generic identity with *X. fulva*. It checked in almost every way with the description of an *X. fulva* cocoon given by Linsley, MacSwain, and Smith (1955) except for its more prominent anterior flange.

After spinning its cocoon and depositing its feces, the larva became considerably smaller, more opaque, quite flaccid, and nearly motionless, even when stimulated. It assumed nearly a circular position in a vertical plane with its head sometimes resting on its posterior end (Fig. 16).

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Attack Habits of *Melanophila consputa* on Fire-killed Pines

(Coleoptera : Buprestidae)

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The attraction of charcoal beetles, *Melanophila consputa* LeConte, to smoke and fire over great distances is a well-known phenomenon (Ricksecker, 1885; Burke, 1919; Linsley, 1943; Linsley and Hurd, 1957). But less has been written about their mating and oviposition behavior. Sharp (1918) observed pairs of a closely related species, *Melanophila acuminata* DeGeer, "on timber whose complete destruction by fire seemed imminent. . . ." Linsley (1943) mentioned that *Melanophila* spp. were the first insects to oviposit on fire-injured wood, and that apparently fire stimulated mating, the beetles remaining in the area afterward to oviposit. He also reported that the beetles, stimulated by heat, were often seen running and flying over hot surfaces.

Sloop (1937) found that only species of *Melanophila* with mesosternal pits fly to fires. The charcoal beetle is included in this group. In experiments with *M. acuminata*, it appeared to Evans (1962) that each pit contained a cluster of olfactory organs capable of detecting low concentrations of smoke.

A 200-acre fire, 3 miles north of Viola, California, offered an opportunity to supplement these observations. The fire started on the evening of 18 August 1963, in a well-stocked, mixed conifer stand which had been logged several years ago. It burned many trees, logs, and stumps, and produced much smoke. The weather was clear and warm, with a prevailing west wind.

The study area, owned by the U. S. Plywood Corporation, was on a ridgetop in the middle of the fire. The lumber company had preserved for study a badly scorched sugar pine, *Pinus lambertiana* Dougl., with a 20-inch diameter at breast height, which was especially attractive to the beetles. The tree was used for most of the observations reported in this paper. But we noted that the beetles also mated and oviposited on nearby ponderosa pine, *P. ponderosa* Laws.

Observations began at dawn the day after the fire started and were continued for 4 days. The burned area was visited 7 and 40 days later. For future collections, tanglefoot traps were put on the study tree the third day after the fire started.

Charcoal beetles began arriving at the tree shortly after sunrise on the first day of observation. Activity seemed confined to the lower 20 to 50 feet of the trunk, and more commonly in full sunshine than in shade. By 10 a.m. the tree was swarming with hundreds of beetles, seeking mates, mating, and ovipositing.

The male appeared to be the aggressor, running about continually seeking a female. When a female was found, the male would mount her and often stroke her with his antennae. The two would remain coupled for 2 or 3 minutes. After mating, the female would seek an oviposition site. The male would either leave the female or would remain mounted during oviposition, and then couple again. Females mated repeatedly with the same male or different males. Several pairs were observed together for periods of 15 to 20 minutes.

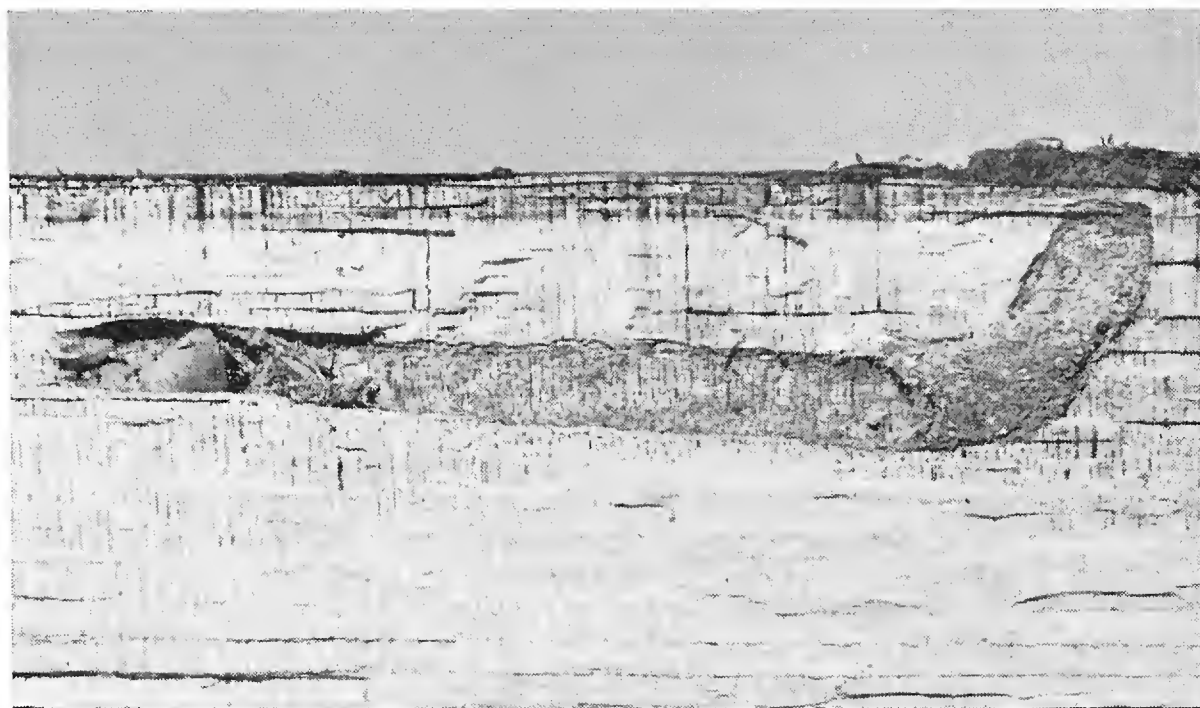
The actions of the male resembled those described by Chemsak (1963) for *Xylotrechus nauticus* (Mannerheim). The males of *M. consputa* often attacked other mating pairs, the larger male usually taking over or retaining position. Males tried to mate with males, whereupon a brief struggle ensued, and the attacker was thrown off. Mating occurred on standing trees, on charred, burning logs, and in the warm ashes.

Females ran about on the trunk, searching with their antennae, and probing for crevices in the bark with their ovipositor. They oviposited repeatedly at different sites. One female apparently oviposited 10 times in an 8-minute period, each act requiring only a few seconds. When several sites were examined, not all contained eggs. The white, oval eggs are small, difficult to see, and probably were often dislodged when the bark was chipped away in a search for them. Apparently a single egg is laid at each oviposition site; however, two or more eggs may have been deposited, but missed during the examination.

Mating and oviposition continued at a diminishing rate as evening approached and temperature and light decreased. After sunset the insects rested in bark crevices, on hot ashes, among rocks at the base of trees, and under hot, smouldering logs.

The ability of certain *Melanophila* to withstand intense heat has been reported previously (Linsley, 1957). I observed this repeatedly during the fire. It was displayed most dramatically on a large, burning log that was producing so much heat that it was impossible to stand closer than 10 feet. The charcoal beetles, however, were running on the log to within inches of the flames.

Activity was resumed on the second morning of observation in much the same pattern as the day before. The fires of the day before were still smoking and, in a few cases, producing flames. The population was ap-



EXPLANATION OF FIGURE

Fig. 1. *Melanophila consputa* larva ready to pupate at end of a gallery. The gallery penetrates the sapwood only 0.5 inch.

parently the same as the day before, beetles no longer flying into the area in large numbers. The numbers of beetles gradually diminished. Mating and egg deposition again stopped at sunset. A few logs and stumps were still burning on the third day, but only a few beetles were found mating and ovipositing. On the fourth day the weather turned cloudy, cool, and windy. The fire was completely out. Beetles were difficult to find.

The area was next visited on 29 August. Charcoal beetles were found on all traps and a few were still flying in the area, but no mating or oviposition was observed. No larvae were found mining the phloem.

The last observations were made 40 days later. A few charcoal beetles were in the tanglefoot traps along with asilid flies, which are apparently predators of this insect.¹ No live beetles were found in the area. Many *M. consputa* larvae were found under the bark on the lower bole of the study tree in different stages of development. Some were fully grown and had bored into the sapwood to a maximum depth of 1 inch below the surface. Most insects had bored only 0.5 to 0.75 inch into the wood, probably to overwinter there as larvae.

Few other wood-boring insects were attracted to the smoke and fire the first several days (Wickman, 1964). By the third day, a few *Urocerus*

¹ An asilid, *Andrenosoma fulvicaudum* (Say), has been found by the author under the bark and reared from fire-killed ponderosa pine infested with *M. consputa* nearby. The fire occurred in August 1961, about 30 miles north of the fire described in this paper.

californicus Norton, *Semanotus amethystinus* (LeConte), *Ergates spiculator* LeConte and male *Syntexis libocedris* Rohwer were caught on the burn. However, charcoal beetles seemed to dominate the scene and established heavy broods under the bark of badly scorched pines. The broods filled the underbark so completely that bark beetles and wood borers requiring phloem were excluded. This monopoly of available host material could have a beneficial effect on the amount of deterioration due to insects in trees killed by fire, if *M. consputa* is the first attacking insect. It burrows only in the outer 0.5 to 1 inch of the wood (Fig. 1). This portion of the log is usually cut off as slabs and burned or chipped at the sawmill.

Keen (1952) reported that this species attacked fir and other conifers. On the Viola burn, however, white fir, *Abies concolor* (Gord. and Glen.) Lindl., was not attacked. Sugar pine and ponderosa pine were the only two species of conifers attacked.

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Immature Habits of Callidiini with a Description of New California *Callidium*¹

(Coleoptera : Cerambycidae)

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Subsequent to the completion of Part V of "A Monograph of the Cerambycidae of North America" (Linsley, 1964) which includes the tribe Callidiini, additional information on the larval and pupal habits of *Semanotus* and *Callidium* has become available. A previously undescribed species of *Callidium* and *Semanotus ligneus amplus* (Casey) was reared from small sections of *Juniperus occidentalis* collected by D. E. Bright and D. Kinn, University of California, Berkeley. Additionally, adults of *Semanotus litigiousus* (Casey) were encountered by splitting a log of *Abies*. To further emphasize and also contrast the biological unity of the Callidiini, the immature habits of these three species are presented along with a description of the *Callidium*.

Callidium angustipennis Chemsak, new species

MALE.—Body moderate sized, elytra narrowly explanate behind humeri then tapering to apices; upper surface dark violet-blue, head and pronotum often greenish, appendages and underside shiny black, nonmetallic. *Head* moderately coarsely, confluent punctate, thinly clothed with fine erect black hairs; antennae extending almost to midelytra, tapering apically, basal segments moderately strongly incrassate. *Pronotum* about $1\frac{1}{2}$ times as wide as long, narrower than elytra at base; sides broadly, evenly rounded, base slightly narrower than apex; disc shining, moderately coarsely, irregularly confluent punctate, often with small, irregular, scattered glabrous areas, sides deeply, rugosely punctate, punctures about equal in size to discal ones; pubescence moderate, fine, black, erect; prosternum punctate like sides of pronotum except for intercoxal process; mesosternum and metasternum vaguely, shallowly punctate, sparsely pubescent. *Elytra* about twice as long as basal width, narrowly explanate from behind humeri, constricting slightly at middle and tapering to apex; punctures coarse, shallow, confluent, and rugose, forming transverse elongate ridges near apices; each elytron bicostate; apices obliquely rounded; scutellum glabrous, shallowly concave. *Legs* with femora strongly clavate, posterior pair reaching to elytral apices. *Abdomen* finely punctate; apex of last sternite broadly subtruncate to shallowly emarginate. Length, 10–12 mm.

FEMALE.—Antennae extending over basal one-third of elytra, basal segments narrower; prosternum shining, finely, shallowly rugulose; femora moderately clavate; apex of fifth abdominal sternite narrowly rounded. Length, 10–14 mm.

Holotype male, allotype female (California Academy of Sciences), and 8 paratypes (4 males, 4 females) from 2 MILES SOUTH ADIN SUMMIT,

¹ This study was conducted during the course of a National Science Foundation sponsored study on North American Cerambycidae (Grant 19959).



MODOC COUNTY, CALIFORNIA, reared from *Juniperus occidentalis* collected on 11 June 1963 (D. E. Bright and D. Kinn) ; emerged during December 1963 and January 1964.

This species is related to *C. juniperi* Fisher by the tapering elytral apices. *C. angustipennis* may be separated by the coarser, more confluent elytral punctures, more shining pronotum with longer lateral punctures, and distinctly costate elytra. The distinct puncturing of the pronotum is characteristic of the group of *Callidium* species utilizing Cupressaceae and Taxodiaceae as hosts.

LARVAL HABITS.—Larval feeding habits and manner of pupation are basically identical to those of other known *Callidium* and, in part, to other Callidiini. As was the case in *C. texanum* Schaeffer (Chemsak, 1962) and *C. antennatum hesperum* Casey (Chemsak and Powell, 1964) the larvae mine beneath the bark, eating away the cambium layer and scoring the underlying surface. Prior to pupation the larvae bore straight into the heartwood and turn to form pupal chambers parallel to the grain of the wood (Fig. 1). A frass plug is placed near the curvature of the gallery leaving the remainder of the tunnel open to the surface (Fig. 1). The entire gallery ranges in length from 35–40 mm with the pupal chamber extending about 20–25 mm beyond the frass plug and having a diameter of 6–8 mm at its broadest point. The emergence holes flare toward one side forming an elongate oval, about 6–10 mm long at the surface (Fig. 1). A few millimeters below this flare, the hole narrows and becomes more ovoid.

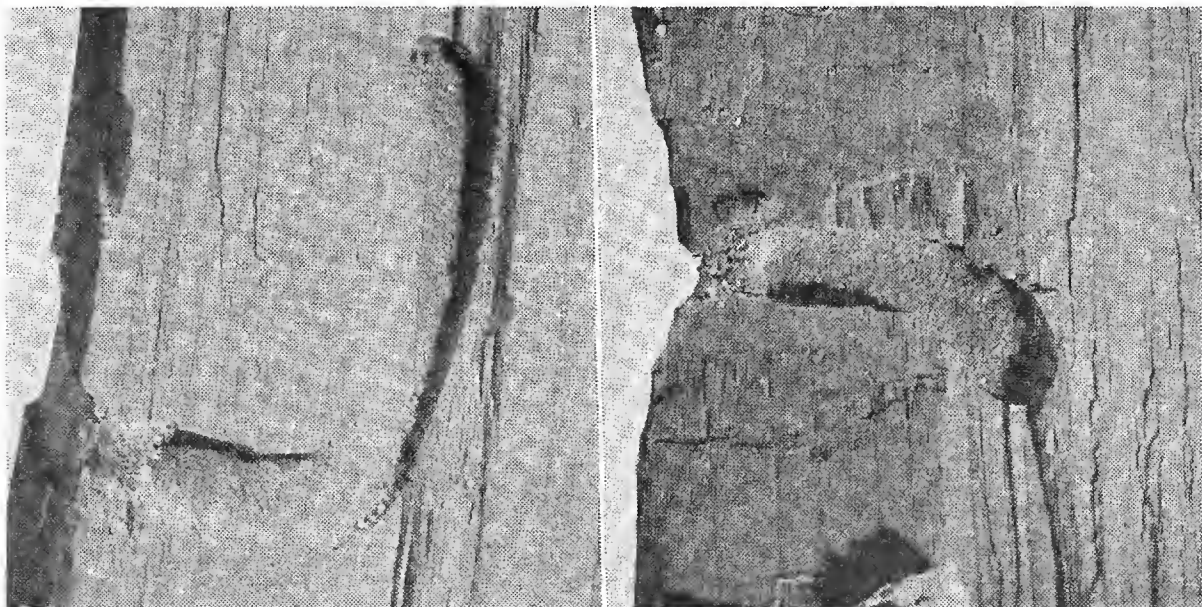
SEMANOTUS LIGNEUS AMPLUS (Casey)

During the course of observations on the preceding *Callidium*, adults and larvae of *Semanotus ligneus amplus* (Casey) were encountered within the same pieces of *Juniperus occidentalis*. The habits of the immatures, while basically similar to those of other callidiines, differ sufficiently to warrant their mention. Larval feeding is indistinguishable from *Callidium* and the construction of the pupal chamber is more or less identical. However, the emergence hole of *S. ligneus amplus* is only slightly oval at the surface with the conspicuous flaring and elongation produced by *Callidium* larvae being absent (Fig. 1). Besides being flush to the surface level, the hole is plugged at the wood surface by very tightly consolidated, hard, frass particles (Fig. 1).

←

EXPLANATION OF FIGURES

Fig. 1. Upper: pupal chamber of *Callidium angustipennis* in *Juniperus occidentalis*; middle: emergence holes of *C. angustipennis* in *J. occidentalis*; lower: emergence gallery and hole of *Semanotus ligneus amplus* in *J. occidentalis*.



EXPLANATION OF FIGURE

Fig. 2. Pupal chambers of *Semanotus litigosus* in *Abies*.

SEMANOTUS LITIGIOSUS (Casey)

The two galleries encountered in the *Abies* log differed in length and configuration (Fig. 2). One had an overall length of 30 mm with only a slight angle while the other measured 55 mm in length with an elongate lower segment. These galleries were much larger in diameter than those of *S. ligneus* in spite of the fact that the two species are about the same size. The surface frass plug is much larger, extending farther into the gallery, but the emergence hole is about the same size and shape as that of *S. ligneus*.

The tight, frass plug at the surface, more rounded emergence hole, and the absence of surface flaring of the hole differentiate the larval work of *Semanotus* from *Callidium* (Chemsak, 1962; Chemsak and Powell, 1964).

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The Genus *Metapogon*

(Diptera : Asilidae)

J. WILCOX

Anaheim, California

Metapogon Coquillett (1904) is an infrequently collected genus of small robber flies, probably because they are only found in the fall, winter, and early spring. The previously described species are: *Cyrtopogon gibber* Williston (1883), *Metapogon gilvipes* and *Metapogon punctipennis* Coquillett (1904), *Metapogon pictus* Cole (1916), and *Metapogon albulus* Melander (1923). *Metapogon setiger* Cole (1919) is the type of the genus *Coleomyia* Wilcox and Martin (1935). Melander (1923) gave a key to the above species with the exception of *Cyrtopogon gibber* Williston. Six species are described as new and unless indicated otherwise, the type will be deposited in the California Academy of Sciences.

A key to the related genera (Wilcox and Martin, 1957) is slightly faulty in view of material collected recently. The third vein does not always branch before the apex of the discal cell (discal crossvein) and does not always possess a stump vein. Except for *Metapogon albulus* Melander, all species have small brown clouds on the crossveins and furcations. *Metapogon albulus* has not been seen, and with its hyaline wings, may not properly belong in *Metapogon*.

I am indebted to E. S. Ross and Paul H. Arnaud, Jr., California Academy of Sciences (CAS); P. H. Timberlake and E. I. Schlinger, University of California Riverside (UCR); J. A. Powell and F. R. Cole, University of California Berkeley (UCB); C. H. Martin, Oregon State University (CHM); Mont A. Cazier, Arizona State University (MAC); Sidney Camras, Chicago (SC); and Eric Fisher, Los Angeles (EF), for the loan of specimens. One specimen from the University of California Davis (UCD) was obtained from C. H. Martin.

KEY TO THE SPECIES

- 1. Wings hyaline, usually with small brown clouds on the crossveins and furcations and sometimes at the tip of the wings 2
Wings yellowish brown, the color intensified on the crossveins and furcations .. 7
- 2. Wings clear hyaline; abdomen silvery gray pollinose, base of segments 2-5 very narrowly devoid of pruinosity; legs black, knees very narrowly yellowish; length 7 mm (Washington, Idaho) *albulus* Melander
Wings at least with brown spots on the crossveins and furcations 3

3. Mesonotal and scutellar bristles white; first two antennal segments yellowish; third vein branched opposite the discal crossvein and usually without a stump vein; length 7–8 mm (New Mexico, Arizona) *punctipennis* Coquillett
- Mesonotal and scutellar bristles black; antennae black; third vein branched before discal crossvein and with a stump vein 4
4. Hairs on the central stripe of the mesonotum short, white 5
- Hairs on the central stripe of the mesonotum black, half as long to subequal in length to dorsocentral bristles 6
5. Three submarginal cells, the tip of the wings hyaline; occipital and bristles below on antennae, yellowish white; anterior corners of abdominal segments bare of pollen, dorsum shining black; length 6 mm (California, Nevada) *tricellus*, new species
- Two submarginal cells, wings with a brown cloud apically; occipital and bristles below on antennae, brownish to black; lateral margins of abdominal segments pollinose, dorsum thinly brown pollinose, subshining; length 6 mm (California, Nevada) *pictus* Cole
6. Central stripe of mesonotum with long sparse black bristles or hairs; tip of the wings narrowly clouded; abdomen except for anterior fasciae and posterior spots, subshining black, largely covered with brown pollen; length 8–9 mm (California) *gibber* (Williston)
- Central stripe of the mesonotum anteriorly with a dense mane of black bristles; tip of wings hyaline; abdomen bare of pollen and shining black except for anterior fasciae and posterior spots; length 9 mm (California) *carinatus*, new species
7. Two marginal scutellar bristles 8
- Four or more marginal scutellar bristles 10
8. Scutellar bristles black; third vein branched beyond end of discal cell and without stump vein; legs brownish yellow, tarsi darker, foretarsi slender and $1\frac{1}{5}$ times the length of tibiae; length 6–8 mm (California) *gilvipes* Coquillett
- Scutellar bristles white; third vein branched before end of discal cell and with a stump vein; femora black except at tip, tibiae and tarsi reddish; foretibiae and tarsi subequal in length 9
9. Scutellum pollinose; anterior fasciae and posterior pollinose spots widely separated on male abdomen and on segments 2–4 of female abdomen; length 7 mm (Arizona) *holbrooki*, new species
- Disc of scutellum bare of pollen; anterior pollinose fasciae and posterior pollinose spots broadly connected on male abdominal segments 2–6; length 8 mm (Baja California) *leechi*, new species
10. Pulvilli $\frac{2}{5}$ length of the claws; dorsum of the tibiae only, reddish; mesonotum wholly pollinose; 2 strong and 2 weak scutellar bristles; abdomen wholly pollinose except for lateral anterior bare spots; length 6–7 mm (California) *hurdi*, new species
- Pulvilli $\frac{4}{5}$ length of claws, tips of femora, tibiae, and tarsi, yellowish red; mesonotum with bare black spots, anterior to and mesally to, the posterior callosity; 5–6 strong scutellar bristles; sides and broad anterior margins of abdominal segments pollinose, connected sometimes on segments 5–6; length 7–8 mm (California) *tarsalus*, new species

Metapogon carinatus Wilcox, new species

MALE.—Length 9 mm. Head black, gray pollinose, thinly so on face. Mystax composed of brownish oral bristles with white tips and fine white hairs extending nearly to antennae; face at antennae $\frac{4}{5}$ width of one eye. Sparse hairs of frons white; ocellar tubercle with 4 black and 2 brownish erect bristles; occipital hairs yellowish; beard and hairs on palpi and proboscis white. Antennae black, hairs white; segment 1 with 2 and segment 2 with 1, white bristles below; segments measure 7-5-23-8.

Mesonotum highly arched in lateral view, black, gray pollinose, the central stripe dull black; intermediate spots, a posterior spot in dorsocentral rows and a spot behind humeri, brown pollinose. Fine sparse hairs crinkly white anteriorly and on humeri. Three presutural bristles brown; others black, 1 supraalar, 1 postalar, 9 dorsocentrals, and a dense crest anteriorly on the central stripe. Pleurae and coxae thinly gray pollinose with a golden tinge, hairs white, hypopleurals yellowish. Scutellum gray pollinose and with a small bare spot at middle basally; dense hairs crinkly yellowish; 2 strong and 2 weaker, black marginal bristles.

Abdomen black; anterior margin and sides of segment 1, anterior margins and posterior corners of 2-7, gray pollinose, widely separated on 2-4, narrowly on 5, and connected on 6-7. Hairs white, long crinkly; lateral bristles on segment 1, yellowish. Genitalia black, almost concealed, gray pollinose in part, dense hairs white.

Legs brownish black, the tibiae dorsally, reddish brown. Hairs white; bristles yellowish; claws black; pulvilli white and about as long as claws; empodia brown, about $\frac{1}{3}$ length of claws.

Halteres brownish, darker basally. Wings hyaline, with small brown clouds on the crossveins and furcations; veins brown, anterior crossvein at $\frac{5}{8}$ length of discal cell, third vein branched before discal crossvein and with a short stump vein; anal cell narrowly open.

FEMALE.—Length 9.5 mm. Similar to male. Face on the sides and the frons, brownish pollinose; mystax with fewer brown bristles on oral margin. Anterior gray pollinose fasciae and spots on the posterior corners, connected on abdominal segments 4-7; short segment 8 and apical spines black. Anterior crossvein a little beyond middle of discal cell 45/80.

Holotype male.—WHITE WATER, CALIFORNIA, 13 January 1948 (J. Wilcox). Allotype female, same data, 27 December 1947. Paratypes, 9 males, 15 females, same data, 25, 28 November 1947, 27 December 1947, 6, 13 January 1948, 8 February 1948 (Guy F. Toland, A. F. Howland, J. Wilcox); 3 females, Palm Springs, California, 7 January 1954, 14 January 1953 (Paul H. Arnaud, Jr.); 1 female, near Ribbonwood, Riverside County, California, about 5,000 feet, 21 January 1963 (E. I. Schlinger), UCR.

METAPOGON GIBBER (Williston)

?*Cyrtopogon gibber* Williston, 1883, Amer. Entomol. Soc. Trans., 11: 14. Type ♀, California (Baron), Univ. Kans.

Cyrtopogon gibber Back, 1909, Amer. Entomol. Soc. Trans., 35: 293.

Metapogon gibber Wilcox and Martin, 1936, Entomol. Amer., 16: 2.

MALE.—Length 8 mm. Similar to female. Oral bristles white with black tips; face

$\frac{3}{4}$ width of one eye; antennal segments measure 6-5-18-9. Black bristles on the central stripe of the mesonotum almost as strong as the dorsocentral bristles and with a few finer black hairs intermixed. Scutellum with sparse short erect yellowish hairs, 2 strong black marginal bristles and 2 weak ones laterally (1 brownish). Genitalia shining black, in part gray pollinose, white haired. Legs black, dorsum of tibiae reddish brown; bristles white to pale brownish. Brown spots of the wings smaller than in the female and brown area at tip of wing smaller; anterior crossvein at $\frac{5}{9}$ length of discal cell.

Hypotype male.—Playa del Rey, Los Angeles County, California, 26 December 1947 (J. Wilcox).

Specimens from the following localities in California:

Long Beach, 29 October, 9 November 1956 (A. F. Howland, Wilcox); Playa del Rey, 26 December 1947 (Dorothy and C. H. Martin, Itol J. and J. Wilcox); Redondo, 26 December 1947 (Martins and Wilcoxes), 10 January 1948 (Guy F. Toland, Wilcox); San Diego, 12 December 1913 (E. P. Van Duzee), December (F. E. Blaisdell); Seal Beach, 3 January 1948 (Wilcox); Ventura, beach sand dunes, 29 December 1950 (Paul H. Arnaud, Jr.).

In the females and in some of the males, the black bristles and hairs on the central stripe are not nearly as long or as strong as the dorsocentral bristles.

METAPOGON GILVIPES Coquillett

Metapogon gilvipes Coquillett, 1904, Entomol. Soc. Washington Proc., 6: 184. Type ♀, Los Angeles Co., Calif., U.S.N.M.

Metapogon gilvipes Back, 1909, Amer. Entomol. Soc. Trans., 35: 304.

MALE.—Length 6 mm. Face gray with a golden tinge on lower half, frons and upper occiput golden brown, lower occiput gray, pollinose. Face at antennae $\frac{4}{5}$ width of one eye; bristles of mystax and occiput yellowish brown; mystax composed entirely of sparse bristles extending $\frac{1}{2}$ distance to antennae; four erect black bristles on ocellar tubercle. Antennae brownish black, a weak brownish bristle below on segment 1 and a black one on 2; segments measure 3-4-12-5.

Mesonotum golden brown pollinose, the widely divided central stripe and small intermediate spots brown. Hairs yellowish, short, sparse; 3 weak humeral bristles brownish; other bristles strong black, 2 presutural, 1 supraalar, 1 postalar, 2 anterior, and 1 posterior dorsocentral. Pleurae and coxae grayish golden pollinose, hairs yellowish, hypopleurals yellowish brown. Scutellum golden brown pollinose, 2 strong black marginal bristles.

Abdomen shining black, sides and base of segment 1, anterior fasciae, and posterior corners connected on segments 2-7 and enclose a small lateral bare spot on segments 3-6, brown pollinose; segment 8 bare. Hairs yellowish; lateral bristles on segment 1 brownish. Genitalia black, hairs yellowish.

Legs brown; hairs yellowish; bristles black; claws black; pulvilli and empodia light brown, pulvilli nearly as long as claws; foretarsi slender, $1\frac{1}{5}$ times length of foretibiae.

Halteres yellowish, base brown. Wings brown, intensified on crossveins and furcations; veins brown, anterior crossvein at $\frac{3}{4}$ length of discal cell, third vein branched beyond discal crossvein and without stump vein, anal cell narrowly open.

Hypotype male.—5.2 miles north Escondido, California, Hwy. 395, 2 October 1963 (M. W. Stone). Specimens of both sexes same data and 9 October 1963 (M. W. Stone, J. Wilcox).

***Metapogon holbrooki* Wilcox, new species**

MALE.—Length 6 mm. Head black, densely white pollinose, frons with a yellowish tinge and the vertex brown. Hairs white, bristles yellowish white; mystax with oral bristles and short sparse hairs above reaching $\frac{2}{3}$ distance to antennae; ocellar tubercle with a pair of weak erect bristles. Face $1\frac{18}{22}$ the width of one eye at antennae. Antennae black, hairs white, segment 1 with 1 and 2 with 2 weak white bristles below; segments measure 6–6–20–4.

Mesonotum black, golden brown pollinose, the divided central stripe brown; a small lateral bare spot behind humeri and another behind suture. Sparse hairs white; bristles white, 2 presutural, 1 supraalar, 1 postalar, 2 anterior, and 2 posterior dorsocentral. Pleurae golden, coxae gray pollinose; hairs white, hypopleurals yellowish. Scutellum golden brown pollinose with a small bare spot at middle basally; short hairs white; 2 yellowish marginal bristles

Abdomen shining black; sides of segment 1, posterior corners of 2–7 and narrow anterior margins of 2–5 gray pollinose. Hairs short inconspicuous yellowish; 4–5 white lateral bristles on segment 1. Genitalia small, brown; hairs white.

Femora black, reddish at tip; tibiae and tarsi yellowish red, foretarsi a little darker. Hairs and bristles white; claws black; empodia and pulvilli white, about as long as claws.

Halteres yellowish red, base brown. Wings light brown, lighter basally, the brown intensified on the crossveins and furcations. Veins brown; anterior crossvein at $\frac{4}{7}$ length of discal cell; third vein branched before discal crossvein and with a stump vein as long as the anterior crossvein; anal cell open.

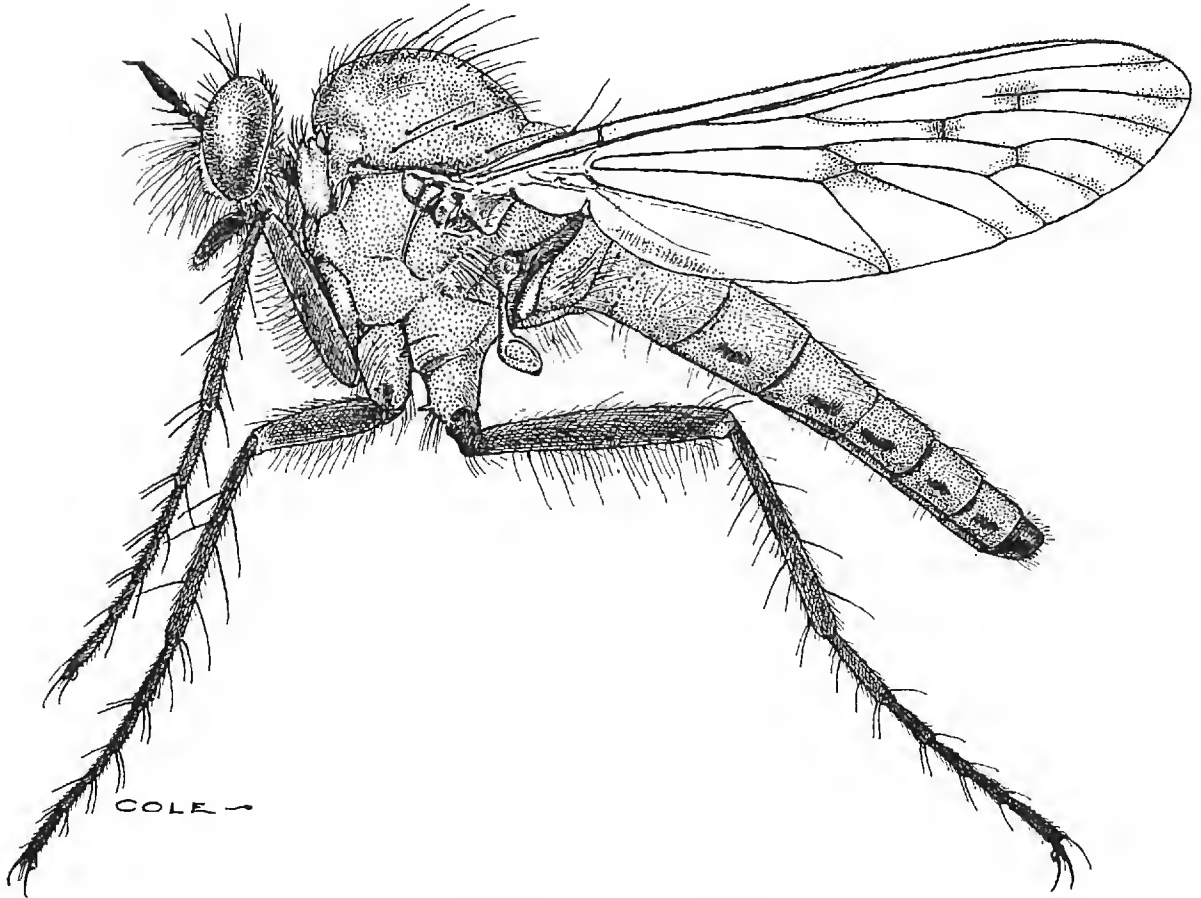
FEMALE.—Length 7 mm. Similar to male. Mesonotum greased. Anterior pollinose bands and posterior pollinose spots on abdominal segments 5–7 confluent and nearly so on 4; segment 8 brown; apical spines brown. Anterior crossvein at $\frac{7}{10}$ length of discal cell.

Holotype male.—12 MILES SOUTH HOLBROOK, ARIZONA, Hwy. 77, 16 August 1948 (Itol J. Wilcox). Allotype female, same data (J. Wilcox). Paratype male, 5 miles south Holbrook, Arizona, 10 August 1948 (J. Wilcox).

***Metapogon hurdi* Wilcox, new species**

MALE.—Length 6.5 mm. Head black, densely grayish white pollinose with a touch of brown on the frons. Mystax white, hairs long sparse with 7 below antennae black; hairs on frons white with several laterally black; ocellar tubercle with 4 strong black bristles and several black hairs; occipital bristles yellowish; beard and hairs of palpi and proboscis white. Antennae black, thinly golden pollinose; hairs black, segment 1 with 1 strong black bristle below and 2 long black hairs, segment 2 with 1 long black hair; segments measure 5–5–15–7; third segment narrowed on apical fourth.

Mesonotum golden brown pollinose, humeri and lateral margins gray, the bisected central stripe and small intermediate spots brown. Hairs long sparse white; bristles black, 2 presutural, 1 supraalar, 1 postalar, and 4 anterior and 3 posterior dorsocentral.



EXPLANATION OF FIGURE

Fig. 1. *Metapogon hurdi* Wilcox, by Frank R. Cole.

Pleurae and coxae grayish pollinose, pleurae above golden, hairs white. Scutellum yellowish gray pollinose with a small central discal spot black; fine sparse hairs white; two strong and 2 weak black marginal bristles.

Abdomen black, densely grayish yellow pollinose, segments 2-6 with small lateral anterior bare spots separated from the lateral margins. Hairs white, rather long; lateral bristles on segment 1 yellowish. Genitalia shining brown and yellowish red, hairs yellowish.

Legs black, dorsum of tibiae reddish; hairs and bristles white; claws and empodia black; pulvilli whitish, short, about $\frac{2}{5}$ as long as claws (measuring each from base of claws). Foretarsi slender, $1\frac{2}{5}$ times as long as foretibiae.

Halteres yellowish, stem brown. Wings tinged with brown, crossveins and furcations with definite brown clouds, anal angle and cell and basal cells nearly hyaline. Veins dark brown, anterior crossvein at $\frac{3}{5}$ length of discal cell; third vein branched opposite discal crossvein and with a stump vein which is longer than the anterior crossvein; anal cell open.

FEMALE.—Length 7 mm. Similar to male. Frons brownish pollinose at middle. Hairs above on antennae mostly white. Segments 2-7 of abdomen with lateral bare spots; segment 8 light brown and bare of pollen; apical spines brown.

Holotype male.—ANTIOCH, CONTRA COSTA COUNTY, CALIFORNIA, 7 November 1958 (P. D. Hurd), UCB. Allotype female, same data. Paratypes, 31 males, 35 females, same locality, 7, 15, 16 November 1958 (P. D.

Hurd, J. R. Powers, R. W. Thorp), UCB; 3 males, 1 female, Antioch, California, 1 November 1946 (S. Camras), SC; 4 males, 6 females, Fresno, California, 3, 12, 29 November 1922, CHM.

The short pulvilli and almost wholly pollinose abdomen separate this species easily from all others.

Metapogon leechi Wilcox, new species

MALE.—Length 8 mm. Head black, gray pollinose, face with a small brown spot below antennae and frons brownish. Mystax with slender yellowish oral bristles and dense white hairs which become shorter and sparse above and nearly reach antennae; face at antennae $\frac{4}{5}$ width of one eye; frons with sparse white hairs; ocellar tubercle with 2 erect yellowish white bristles; occipital bristles yellowish white; beard and hairs of palpi and proboscis white. Segment 1, base and apex of 3 and style of antennae, black; segment 2 and middle of 3, yellowish; short hairs white, segment 2 with a short white bristle below; segments measure 5–8–24–5.

Mesonotum black, yellowish brown pollinose, the divided central stripe and small intermediate spots dark brown. Hairs short, yellowish white; bristles yellowish white, 2 presutural, 1 supraalar, 1 postalar, and about 10 dorsocentral. Pleurae and coxae golden brown pollinose, hairs and bristles yellowish white. Disc of scutellum shining brown, narrowly margined with golden brown pollen, 2 yellowish white marginal bristles.

Abdomen black; sides of segment 1, anterior margins connected obliquely to posterior corners of segments 2–6, yellowish brown pollinose, the anterior corners and most of dorsum of 2–6 and 7 wholly, bare of pollen. Hairs and lateral bristles on segment 1 yellowish white. Genitalia black, hairs yellowish white.

Femora black; tips of femora and the tibiae reddish brown; tarsi brown. Hairs and bristles yellowish white; claws black; pulvilli light brown and about as long as claws; empodia brown and half the length of the claws.

Halteres yellowish white, lower stem brown. Wings light brown, intensified on the crossveins and furcations; veins brown, anterior crossvein at $\frac{2}{3}$ length of discal cell; third vein branched before discal crossvein, stump vein as long as anterior crossvein; anal cell narrowly open.

Holotype male.—3 MILES SOUTHWEST MISSION SAN JAVIER, BAJA CALIFORNIA, 14 December 1958 (H. B. Leech), CAS.

METAPOGON PICTUS Cole

Metapogon pictus Cole, 1916, *Psyche*, 23: 65, Pl. IX, Fig. 5. Type ♂, East Highlands, Calif., February 1915 (F. R. Cole), USNM.

Metapogon pictus Melander, 1923, *Psyche*, 30: 211.

FEMALE.—Length 6 mm. Face and frons in part white and brown pollinose, oral and other bristles brownish, hairs white, antennae with a brownish bristle below on segments 1 and 2, segments measure 5–5–14–7. Mesonotum highly arched in lateral view; hairs short white; bristles brownish to black, 2 presutural, 1 supraalar, 1 postalar, and 6 dorsocentral. Sides and anterior margin of abdominal segment 1, anterior margin and posterior corners of 2–7 whitish pollinose, confluent on 5–7 and nearly so on 4 and enclosing an anterior bare spot, wholly covered with a thin brown bloom except anterior corners; segment 8 bare brown; apical spines brown.

Legs black, dorsum of tibiae and tarsi brownish, bristles white to brownish, pulvilli almost as long as claws. Wings hyaline with brown spots on the crossveins and furcations, apical third lightly clouded and narrow apical margin brown.

Hypotype female.—Crafton, California, 15 February 1945 (J. Wilcox).

Specimens have been seen from the following localities:

California: Anderson Springs, Lake County, 6 February 1952 (W. R. Bauer); Beverly Glen (Eric Fisher); East Highlands, 24 November 1956 (J. Wilcox); Forest Home, 14 March 1934 (M. W. Stone); Mill Creek, 6,000 feet, 23 May 1938 (P. H. Timberlake); Monrovia Canyon, 21 February 1932 (Dorothy and C. H. Martin); Riverside, 3 January 1930, 29 January 1925, 4 March 1940, 30 April 1925, 5 November 1933, 20 November 1924, 18 December 1929 (P. H. Timberlake); 8 miles east Sunnymead, 27 March 1959 (E. I. Schlinger); Victorville, 9 miles south, 28 October 1934 (P. H. Timberlake).

Nevada: Glenbrook, Hwy. 50, 5,500 feet, 15 May 1956 (J. Wilcox).

METAPOGON PUNCTIPENNIS Coquillett

Metapogon punctipennis Coquillett, 1904, Entomol. Soc. Washington Proc., 6: 182.

Types ♂ ♀, Organ, N. Mex. (T. D. A. Cockerell), USNM.

Metapogon punctipennis Back, 1909, Amer. Entomol. Soc. Proc., 35: 305.

Specimens have been seen from the following localities:

New Mexico: 5.3 and 8.1 miles east Mesilla Park, Dona Ana County, 30 September 1962 (P. H. Timberlake, C. S. Papp), collected at the base of the Organ Mountains and have been labeled Topotypes; 12.1 miles south Hot Springs, Sierra County, 29 September 1962 (C. S. Papp).

Arizona: 3 miles east Pantano, 20 October 1962 (J. Wilcox); 2 miles northeast Portal, 19 September 1962 (J. Wilcox), 4 October 1960 (Mont A. Cazier); Santa Catalina Mountains, Sabino Canyon, 19, 20, 25 October, 7 December 1962 (J. Wilcox).

Metapogon tarsalus Wilcox, new species

MALE.—Length 7 mm. Head black, gray pollinose, face and frons with yellowish tinge. Oral bristles yellowish white with long white hairs above almost extending to antennae; face at antennae subequal to width of one eye; frons with short fine yellowish white hairs; ocellar tubercle with 4 erect black bristles; occipital bristles yellowish; beard and hairs of palpi and proboscis white. Antennae black; hairs yellowish; 2 black bristles below on segment 1, and 1 on 2; segments measure 5–5–15–7.

Mesonotum black, postalar callosity yellowish; gray pollinose, the central stripe and intermediate area brown; a bare lateral spot behind suture and another between postalar callosity and dorsocentral rows shining black. Sparse hairs yellowish white; bristles black, 2 presutural, supraalar and postalars missing but apparently 1 each, 7 dorsocentral. Pleurae and coxae gray pollinose with golden tinge, hairs white, hypopleurals yellowish. Scutellum gray pollinose with small round bare spot on disc, fine hairs white, apparently 6 strong black marginal bristles (4 missing).

Abdomen black, becoming brown apically; sides, posterior corners, and anterior margins yellowish gray pollinose, the pollen confluent on segments 2, 5–6 and en-

closing a small lateral black spot. Hairs yellowish white, about 6 yellowish lateral bristles on segment 1. Small genitalia brown, hairs yellowish.

Femora black, tips of femora and remainder of legs yellowish red, the tarsi darker. Claws black; pulvilli light brown and $\frac{4}{5}$ length of claws; empodia brown and $\frac{2}{3}$ length of claws; hairs yellowish white; bristles yellowish. Foretarsi slender, about $1\frac{1}{3}$ times length of foretibiae.

Halteres yellowish. Wings brown, more intense on crossveins and furcations; veins brown, anterior crossvein at $\frac{7}{11}$ length of discal cell, third vein branched before discal crossvein and stump vein longer than the anterior crossvein, anal cell narrowly open.

FEMALE.—Length 8 mm. Similar to male. One supraalar and 1 postalar, and 6 marginal scutellar bristles. Abdominal segments 5–7 with the pollen connected from the posterior corners to the anterior fasciae; segment 8 brown; apical spines black.

Holotype male.—HAYWARD, ALAMEDA COUNTY, CALIFORNIA, October 1940 (Arthur J. Walz), CAS. Allotype female, same data. Paratypes, ♂ ♀, same data; 1 female, Berkeley, California, 24 October 1913 (E. P. Van Duzee), UCB; 1 female, Carmel, California, 26 October 1930 (L. S. Slevin), CAS; 1 male, Coyote Creek, near Warm Springs, Alameda County, California, 1 October 1958 (Don Burdick), UCB; 1 female, Mariposa, Mariposa County, California, 19 October 1947 (Paul H. Arnaud, Jr.), collected in bottom of dry creek, 2 to 3 feet wide, JW.

Metapogon tricellus Wilcox, new species

MALE.—Length 6 mm. Head black; face and frons yellowish gray pollinose, face with brown pollinose spots on either side, occiput gray pollinose. Oral bristles brown with white tips, hairs above long white and nearly reaching antennae; face $\frac{3}{4}$ width of one eye; hair on frons white; 4 erect black bristles on ocellar tubercle; occipital bristles yellowish; beard and hairs of palpi and proboscis white. Antennae black; hairs white; bristles white, 2 below on segment 1 and 1 on 2; segments measure 5–5–18–5.

Mesonotum black, yellowish gray pollinose, the widely separated central stripe and intermediate spots brown. Short sparse hairs white; 2 presutural bristles brown, remainder black, 1 supraalar, 1 postalar, 6 anterior, and 2 posterior dorsocentral. Pleurae and coxae yellowish gray pollinose, hairs white, hypopleurals yellowish white crinkly. Scutellum yellowish gray pollinose, 2 strong black marginal bristles.

Abdomen black; anterior margin of segments 1–7 and small posterior corners of 2–7, gray pollinose, confluent on 6–7. Hairs white; lateral bristles on segment 1 white. Genitalia small, brown gray pollinose dorsally, hairs white.

Legs black, tibiae dorsally brown; hairs white; bristles yellowish; claws black; pulvilli whitish and about as long as claws; empodia brown and about $\frac{1}{2}$ length of claws.

Halteres yellowish, brown basally. Wings hyaline with small brown clouds on crossveins and furcations. Veins brown, anterior crossvein at $\frac{3}{5}$ length of discal cell; third vein branched before discal crossvein and the anterior branch connects with the second vein forming 3 submarginal cells; anal cell open.

FEMALE.—Length 7 mm. Similar to male. Eight dorsocentral bristles but only four

anterior. Anterior fasciae and posterior pollinose spots confluent on abdominal segments 5-7; segment 8 bare, brown; apical spines black.

Holotype male.—WHITE WATER, CALIFORNIA, 28 November 1947 (J. Wilcox). Allotype female, same data, 27 December 1947. Paratypes, 2 males, 3 females, same data and 6 January 1948 (A. F. Howland, J. Wilcox); 1 female, Palm Springs, California, 6 January 1954 (Paul H. Arnaud, Jr.), 1 female, R. R. Station, 11 November 1941 (J. Wilcox); 1 female, Reno, Nevada, Washoe County, 3 April 1959 (F. D. Parker), UCD.

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1957. *Backomyia* (Diptera-Asilidae), a new genus. *Jour. Kansas Entomol. Soc.*, 30: 1-5.
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CORRECTION OF SCIENTIFIC NAMES

The following errors in issues of the journal over the past several years have been reported. These are listed and corrected below.—Ed.

TIMBERLAKE, P. H. 1961. A review of the genus *Conanthalictus*. *Pan-Pac. Entomol.*, 37 (3): 145-160.

The names of three of the new species described were misplaced. On page 151 for "*deserticola*" read *minor*, on page 152 for "*namatophilus*" read *deserticola*, and for "*minor*" on page 153 read *namatophilus*.—P. H. Timberlake, University of California, Riverside

SNELLING, ROY R. 1963. A host of *Macrosaigon cruentum* (Genmar) in Georgia (Coleoptera: Rhipiphoridae). *Pan-Pac. Entomol.*, 39 (2): 87-88.

On page 87 "(Genmar)" should read (Germar); page 87, line 11 of first paragraph, "*pestinatum*" should read *pectinatum*; page 88, under literature cited, line 2, "*yavipenne*" should read *flavipenne*.—R. R. Snelling, Los Angeles County Museum, Los Angeles, California

TOSCHI, CATHERINE A. 1964. Observations on *Lomamyia latipennis*, with a description of the first instar larva (Neuroptera: Berothidae). *Pan-Pac. Entomol.*, 40 (1): 21-26.

The first centered heading on page 24, "Eggs of *Lomamyia occidentalis*," should read Eggs of *Lomamyia latipennis*.—Catherine A. Toschi, University of California, Berkeley

A New Species of *Lucifotychus*

(Coleoptera : Pselaphidae)

A. A. GRIGARICK AND R. O. SCHUSTER

University of California, Davis

The distribution of the species of this rather small genus is limited to the Pacific Northwest and, to date, to Oregon and Washington. The adult males of *Lucifotychus* Park and Wagner are distinguished by the following external and internal structures.

1. Protrochanter armed 2
 Protrochanter simple *inornatus*, new species
2. Dorsal lobe of genitalia with numerous spine-like teeth
 *impellus* (Park and Wagner)
 Dorsal lobe of genitalia membranous and minutely setate
 *agomphus* Grigarick and Schuster

***Lucifotychus inornatus* Grigarick and Schuster, new species**

MALE.—(Slide) Head 330 μ long; antennal club 375 μ long. Eyes well developed. Mandibular rami with six subapical teeth; maxillary palpus segment lengths/widths: I 36/15 μ , II 195/65 μ , III 136/50 μ , IV 213/82 μ with terminal palpal cone 60 μ long and subapical projection 15 μ long. Pronotum approximately 375 μ long. Elytra 600 μ long, apparently brachypterous. All trochanters simple; metatibia 500 μ long; each tibia with distal spine. Metasternum with transverse apophysis between mesocoxae, extending not much higher than coxae; apex of apophysis gently curved, with posterior surface flat. Posterior margin of tergite IV transverse, that of sternite VI weakly concave.

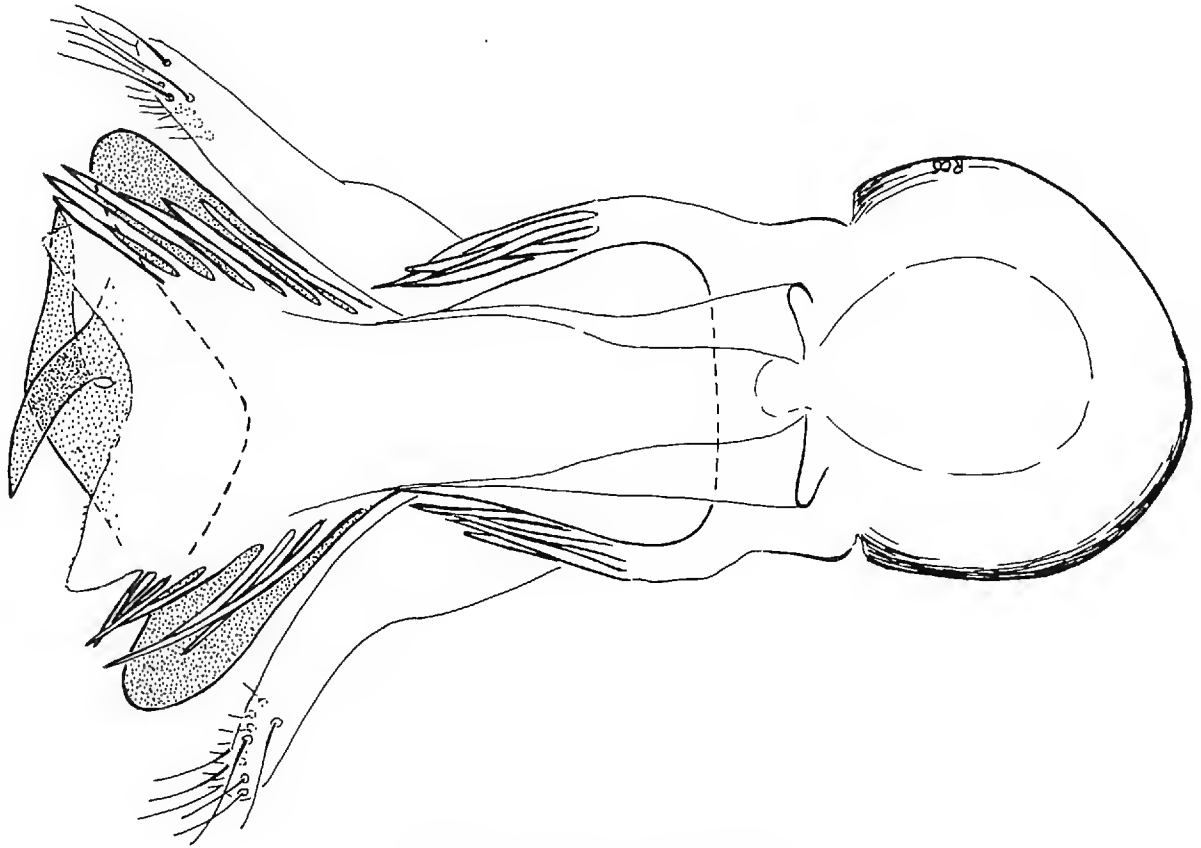
Aedeagus (see Fig. 1) 454 μ long, base two-fifths length, each paramere distally membranous; dorsal part of median lobe distally bears long crossing spines, lateral margins fringed with large setae; basal section of median lobe an angulate Y-shaped structure.

Female unknown.

Holotype male.—Collected at MYRTLE GROVE, LEOB STATE PARK, 7 MILES EAST OF BROOKINGS, CURRY COUNTY, OREGON. It was recovered from forest floor litter on 22 May 1957 by H. S. Dybas and is deposited in the Chicago Natural History Museum.

In 1952, Grigarick and Schuster redefined *Lucifotychus* as having males with the following characters: (1) metasternum with a process between or immediately behind the mesocoxae; (2) protrochanters and metatrochanters armed; and (3) aedeagus of a particular configuration. The genus then included two species, *L. agomphus* and *L. impellus*, which differ as indicated in the preceding key. *Lucifotychus inornatus*

is proposed on the basis of a unique male because the normal armature of the trochanters is absent, thus requiring modification of the generic concept.



EXPLANATION OF FIGURE

Fig. 1. *Lucifotychus inornatus*, aedeagus of holotype male, dorsal aspect.

A number of populations have been sampled that are similar to *L. impellus* in trochanteral characteristics but differ in the size, shape, and location of the metasternal apophysis, configuration of the median lobe of the aedeagus, and the numbers of teeth along the median lobe of the aedeagus. These differences eventually may be shown to be of sufficient magnitude to merit the naming of additional species in this genus.

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- GRIGARICK, A. A., AND R. O. SCHUSTER. 1962. Notes on Tychini from western North America (Coleoptera : Pselaphidae). *Pan-Pac. Entomol.*, 38: 169-178.
- PARK, O., AND J. WAGNER. 1961. In Hatch, M. H., The beetles of the Pacific Northwest, Part III. *Univ. Washington Publ. Biol.*, 16: 1-380.

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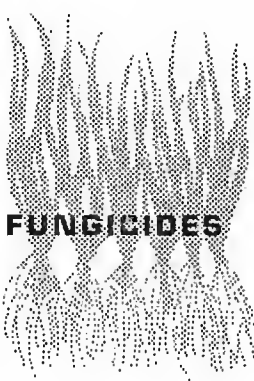
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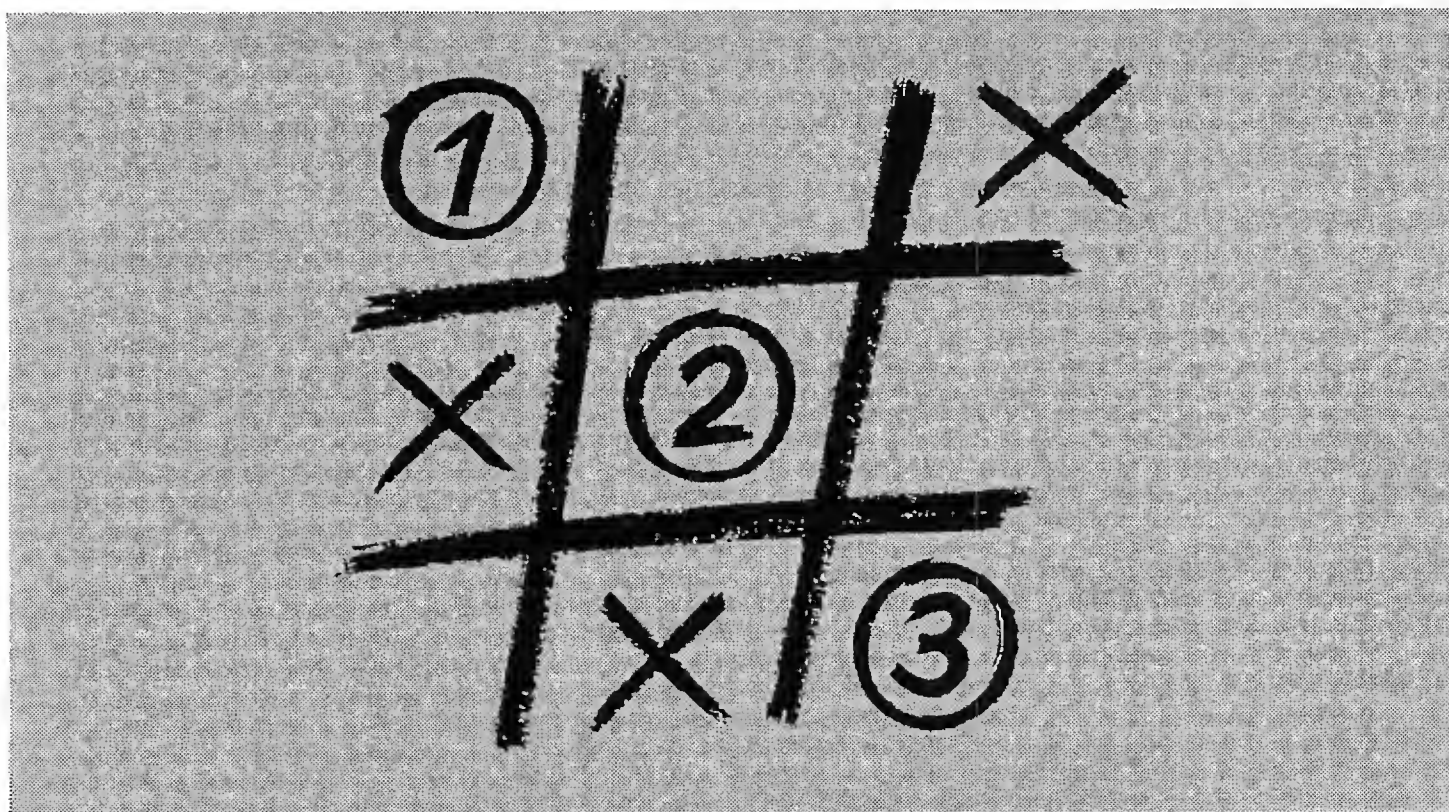
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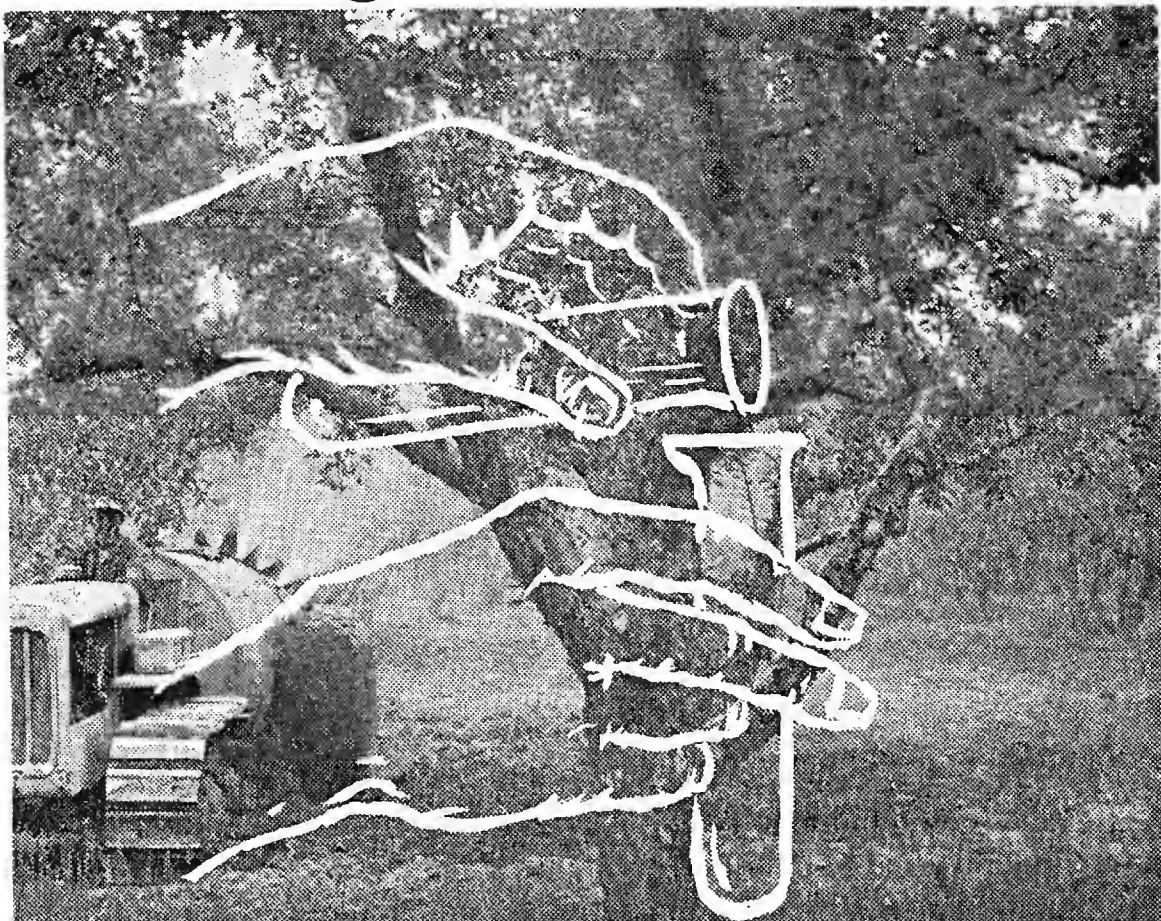
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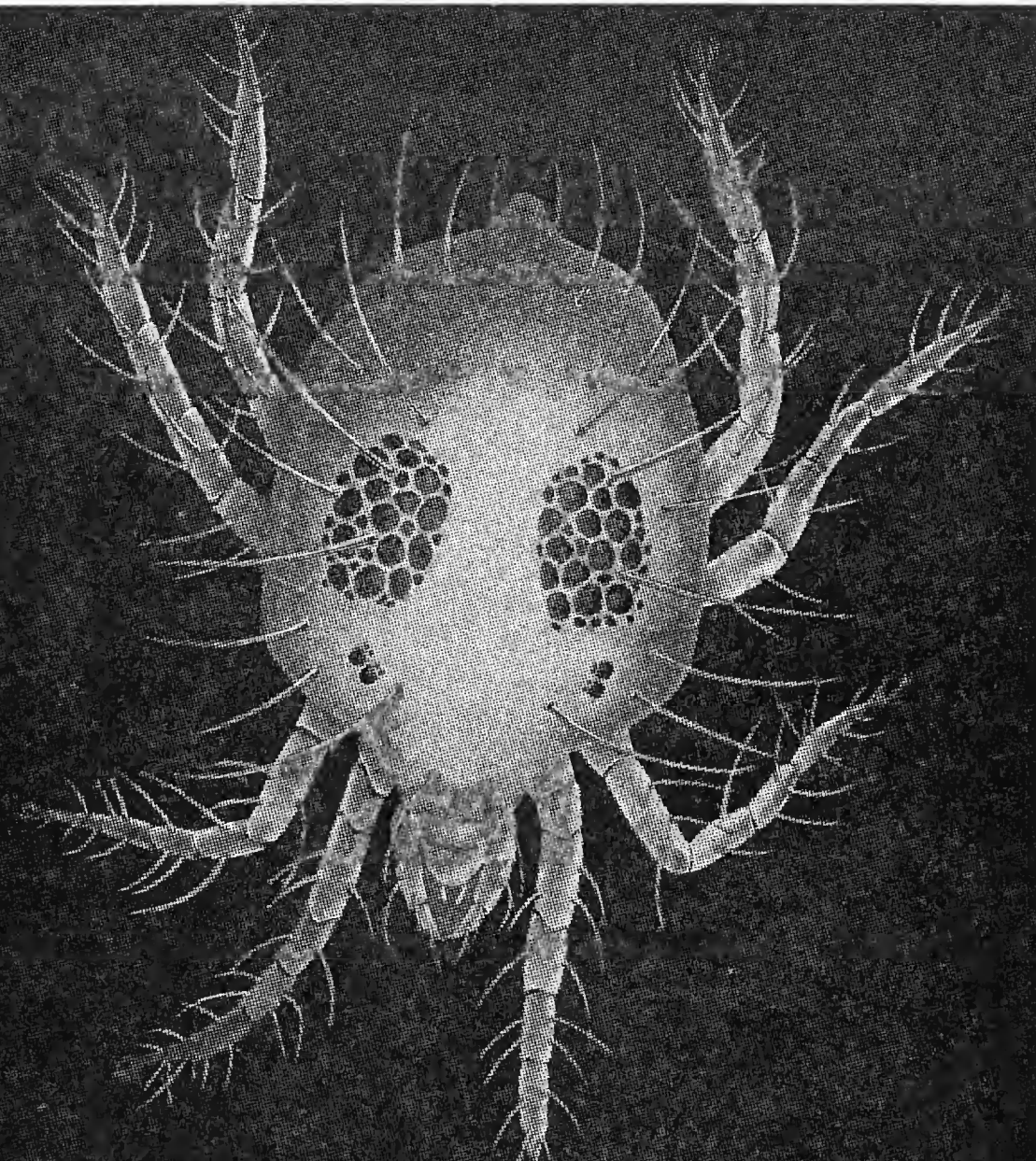
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Essig, E. O. 1926. A butterfly migration. *Pan-Pac. Entomol.*,
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PAN-PACIFIC ENTOMOLOGIST



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Published quarterly in January, April, July, and October with Society Proceedings appearing in the January number. All communications regarding nonreceipt of numbers, requests for sample copies, and all financial communications should be addressed to the Treasurer, Dr. Paul H. Arnaud, Jr., California Academy of Sciences, Golden Gate Park, San Francisco, California 94118.

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The annual dues, paid in advance, are \$5.00 for regular members of the Society or \$6.00 for subscriptions only. Single copies are \$1.50 each or \$6.00 a volume. Make checks payable to *Pan-Pacific Entomologist*.

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Title of Publication: The Pan-Pacific Entomologist

Frequency of Issue: Quarterly (January, April, July, October)

Location of Office of Publication, Business Office of Publisher, Publisher and Owner: Pacific Coast Entomological Society, California Academy of Sciences, Golden Gate Park, San Francisco, California 94118.

Editor: Dr. Howell V. Daly, 112 Agriculture Hall, University of California, Berkeley, California 94720.

Managing Editor and Known Bondholders or other Security Holders: none.

This issue mailed 28 October 1964

Second Class Postage Paid at Lawrence, Kansas, U.S.A.

THE ALLEN PRESS PRINTED IN U.S.A. LAWRENCE, KANSAS

The Pan-Pacific Entomologist

Vol. 40

OCTOBER 1964

No. 4

Studies on the Ecology of *Drosophila* in the Yosemite Region of California. V. A Preliminary Survey of Species Associated with *D. pseudoobscura* and *D. persimilis* at Slime Fluxes and Banana Traps

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Four species of the *pseudoobscura* subgroup of *Drosophila* occur in the western part of the United States: *D. pseudoobscura*, *D. persimilis*, *D. miranda*, and *D. frolovae*. Practically nothing is known about the last, but the first three species have received considerable attention from the standpoint of genetics, and of these, the first two have been intensively studied from the point of view of population structure, both in the field and in the laboratory.

Information on the ecology of *D. pseudoobscura* and *D. persimilis* has not been ignored, but it has been restricted to aspects such as diurnal periodicity, migration, estimates of population size, seasonal cycles, and food preferences (Dobzhansky and Epling, 1944; Dobzhansky and Wright, 1943; and da Cunha *et al.*, 1951), all of which can be observed or inferred simply by collecting these flies with the aid of traps. Further ecological data on these species could hardly be obtained without the knowledge of their natural breeding sites. This critical gap in information was filled by Carson (1951), who discovered that, at least in the Mather region of California, these species utilize the infected sap exudations (slime fluxes) of *Quercus kelloggii*, the California black oak, as feeding and breeding sites (Figs. 1 and 2).

With the discovery of the breeding and feeding sites of these two species of *Drosophila* it has been possible to investigate various problems bearing further on the ecology of these fruit flies: Cooper and Dobzhansky (1956) have reported on the relative abundance of 14 species of *Drosophila* known to occur at Mather and at other localities of the Yosemite region; Phaff *et al.* (1956) have described the yeasts found in the alimentary canal of *Drosophila*, and Carson *et al.* (1956) the various yeasts found in exudations of the black oak and other species of trees; Dobzhansky *et al.* (1956), by exposing traps inoculated with cultures of yeast isolated from the digestive tract of several species of



Drosophila and from slime fluxes, have expanded the data on attractivity of the various species of yeast to populations of various species of *Drosophila* inhabiting the Mather and Aspen localities.

The purpose of the present paper is to fill yet another gap in information available regarding natural populations of *Drosophila pseudoobscura* and *D. persimilis*, namely, the position of these fruit flies in the general biota of a particular area. For this purpose, arthropods occurring at oak slime fluxes in the Mather locality of California have been collected, where possible the behavior of the organisms recorded, and their feeding habits checked. It is hoped that such studies may reveal which are the predators, competitors, and associates of *Drosophila*, and perhaps lead to a solution of a paradoxical situation, namely, the apparent lack of competition between *Drosophila* and other organisms, inferred from the relatively large size of flies collected in the field as compared with the size of flies produced by larvae known to be at competition densities (Sokoloff, 1955).

Since *D. pseudoobscura* and *D. persimilis* are known to occur in areas where the California black oak or other oaks are absent, a parallel study has been made of forms attracted to banana traps, to ascertain to what extent the banana trapped material resembles the material trapped from the natural breeding sites of *Drosophila*.

MATERIALS AND METHODS

The material for this investigation was collected in several localities in the Yosemite region of California. Two of these, Mather and Timberline, have already been described in the first paper of this series by Cooper and Dobzhansky (1956). The third locality, here referred to as Mono Lake, is situated about 20 miles south of Lee Vining, California, approximately 1 mile south of the Big Springs campground. The coniferous forest of this area belongs to the Transition life zone, consisting exclusively of *Pinus jeffreyi*. It is located at an altitude of 8,000 feet, in the Inyo National Forest.

Several methods were used to obtain the material. Banana traps were used in all collecting areas. Fermented banana mash was introduced into plastic cups, and these were placed on wire ring stands near the

EXPLANATION OF FIGURES

Fig. 1 (upper), The trunk of *Quercus kelloggii* showing the characteristic stain which appears after the tree begins to exude sap. Fig. 2 (lower), A close-up of the site from which sap flows. This slime flux was suitable to *Drosophila* as a breeding place.

trunk, on the shady side of trees. Flies attracted to this medium were transferred to vials with the aid of a glass funnel. This method did not work on beetles, since they tended to drop to the ground or to the bottom of the cup when they were disturbed. They were extricated from the medium by any means available, but usually with the aid of forceps.

The rest of the collection was obtained from slime fluxes. Adult Diptera visiting these sites were trapped with a shell vial. Fairly large arthropods were collected by hand, others with the aid of forceps. It is evident that such methods of collection were highly inefficient, but they permitted observations on the behavior of the various organisms before capturing them.

Other material was obtained after removing part of the bark around the slime flux and some of the slime. In the laboratory, both the bark and the slime were examined with the aid of a dissecting microscope. Some of the larvae and small adult arthropods were preserved immediately. Other larvae were allowed to complete their development, and the emerging adults were subsequently preserved. Part of the slime served as bait in the capture of some flies. At dusk, it proved especially attractive to nematocerans of the families Lycoriidae (Sciaridae) and Psychodidae. This slimy material also proved to be an excellent nutrient medium: in plugged shell vials containing this substance, rich cultures of nematodes, collembolans, and several species of mites developed in a few weeks.

RESULTS

Of far the greatest interest is the Mather material since it was collected over a period of nearly 3 months and it originated from slime fluxes and traps, whereas the material from other areas was collected strictly from banana traps, and only during brief collecting periods, not more than a week at a time at the collecting sites.

Even at Mather the material from the two sources (traps and fluxes) is not strictly comparable: the traps were not placed directly on the ground, they were exposed only late in the afternoon when the fruit flies were active, and they varied in the freshness and moisture content of the bait. Material from the slime fluxes, on the other hand, was collected at any (free) time of the day except late in the afternoon when *Drosophila* are attracted to traps.

However, the primary interest (at least in this preliminary survey) is in the qualitative aspects of the fauna attracted to the two sources of food; therefore, the differences in the time of day when the material was collected are not taken into account. It might be pointed out that *D. pseudoobscura* and *D. persimilis* are not attracted to banana traps in

the middle of the day but they come to them in the early morning and late afternoon (see Dobzhansky and Epling, 1944). On the other hand, these fruit flies have been seen at slime fluxes at all times of the day, but they disappear as darkness falls. Thus, it has been possible to observe the behavior of these insects and their associates in their natural surroundings.

It is evident from Table 1 that there are considerable differences between the forms collected from slime fluxes and by means of banana traps. This is not unexpected, since the traps were set off the ground, preventing most crawling forms from reaching the trap. Furthermore, the traps were exposed only for a few hours of the late afternoon. Nevertheless, there are similarities in the type of insects attracted to both traps and sap fluxes: two species of Formicidae (*Camponotus* and *Liometopum*); one species of nitidulids (*Colopterus truncatus*), and several genera of Diptera (*Aulacigaster*, *Dasyhelea*, *Helina*, *Megaselia*, *Minettia*, and *Myospila*). The species of *Drosophila* known to be attracted to both sap fluxes and banana traps are *D. pseudoobscura*, *D. persimilis*, *D. californica*, *D. victoria*, *D. subfunnebris*, *D. pinicola*, and *D. busckii* (Carson, 1951, and personal observations).

A large number of genera have been collected only from slime fluxes: two genera of ants (*Leptothorax* and *Crematogaster*); seven genera of beetles (*Holciophorus*, *Eleodes*, *Melanotus*, *Enicmus*, *Nosodendron*, *Aliochara*, and *Atheta*); and 13 genera of flies (*Scythropochroa*, *Bradyzia*, *Mycetaulus*, *Pericoma*, *Telmatoscopus*, *Periscelis*, *Eucalliphora*, *Phormia*, *Ravinia*, *Forcipomya*, a species near *Culicoides*, a tendipedid, and *Coenosia*). No species of *Drosophila* is known to be attracted only to slime fluxes.

Much of the material obtained from slime fluxes consisted of non-flying forms. Some of the insects were found in the slime itself, others outside or in the immediate vicinity of the slime. The organisms collected and listed in the table were all in the vicinity of the slime flux, not more than 1 inch on either side of the flow of sap. It was noted that, concealed in the crevices of the bark where the sap flowed and the humidity was high, were the chilopods *Ethopolis* (Cryptopidae) and *Theatops* (Lithobiidae); on the bark near the flux were the spiders *Metaphidippus* (Attidae), *Coriarachne*, and *Misumenops* (Thomisidae). Immature spiders such as *Meioneta* and *Spirembolus* (Linyphiidae), and *Euryopsis* (Theridiidae), had built their webs on the crevices near or over the slime fluxes. The lathridiid *Enicmus*, springtails of the family Entomobryidae, the corrodentian *Liposcelis*, and pseudoscorpions of the tribe Chernetinae were found in the interstices of the bark

Table 1. Fauna (exclusive of *Drosophila*) collected by means of banana traps or from slime fluxes in the three localities in the Yosemite and Mono Lake regions of California.

Organism	Locality			
	Mather		Timberline (Trap)	Mono Lake (Trap)
	Flux	Trap		
NEMATODA	x			
CHILOPODA				
Cryptopidae				
<i>Ethopolis xanti</i> (Wood)	x			
Lithobiidae				
<i>Theatops erythrocephalus cali-</i> <i>fornicus</i> Chamberlain?	x			
ARACHNIDA				
ACARINA				
Tarsonemidae				
<i>Tarsonemus</i> sp.	x			
Canestriniidae				
Genus?	x			
Oribatulidae				
<i>Liebstadia</i> sp.	x			
Urodinychidae				
<i>Leiodinychus</i> sp.	x			
Anoetidae				
<i>Histiostoma</i> sp.	x			
CHELONETHIDA				
Tribe Chernetinae (immature)	x			
ARANEIDA				
Attidae				
<i>Metaphidippus aeneolus</i> Curtis	x			
Thomisidae				
<i>Coriarachne versicolor</i> Keyserling			x	
<i>Misumenops californicus</i> Banks (immature)	x			
Linyphiidae				
<i>Meioneta</i> sp. (immature)	x			
<i>Spirembolus</i> sp. (immature)	x			
Theridiidae				
<i>Euryopsis formosus</i> Banks	x			
INSECTA				
COLLEMBOLA				
Entomobryidae				
Genus?	x			
BLATTARIA				
Blattidae				
<i>Parcoblatta americana</i> (Scudd.)	x	x		

Table 1 (continued)

Organism	Locality			
	Mather		Timberline (Trap)	Mono Lake (Trap)
	Flux	Trap		
ORTHOPTERA				
Tettigoniidae				
<i>Pristoceuthophilus pacificus</i> (Thomas)	x			
<i>Gammarotettix cyclocercus</i> Hebard	x			
PSOCOPTERA = (CORRODENTIA)				
Liposcelidae				
<i>Liposcelis</i> sp.	x			
HEMIPTERA				
Lygaeidae				
<i>Eremocoris inquilinus</i> Van D.	x			
DIPTERA				
Psychodidae				
<i>Pericoma</i> sp.	x (L) *			
<i>Telmatoscopus</i> sp.	x			
Chironomidae = (Tendipedidae)	(L)			
sp. of Pelopiinae				
Ceratopogonidae = (Heleidae)				
<i>Forcipomya</i> sp.	(L)			
<i>Dasyhelea</i> sp.	(L)	x		
Genus near <i>Culicoides</i>	(L)			
Sciaridae = (Lycoriidae)				
<i>Scythropochroa</i> sp.	x			
<i>Bradysia</i> sp.	x			
<i>B. fenestralis</i> (Zett.)	x (L)			
Cecidomyiidae = (Itonididae)				
Tribe Itonidini			x	
Phoridae				
<i>Megaselia</i> sp.	x (L)		x	
Calliphoridae				
<i>Eucalliphora lilaea</i> (Walk.)	x			
<i>Phormia regina</i> (Mg.)	x			
<i>Calliphora livida</i> Hall				x
Sarcophagidae				
<i>Ravinia lherminieri</i> (R-D)	x			
Muscidae				
<i>Helina</i> sp.	x	x		
<i>Fannia</i> sp.		x		
<i>Muscina</i> sp.		x		x
<i>Muscina</i> sp. (<i>aurantiaca</i> Hough?)				x
<i>Paregle cinerella</i> (Fall.)		x	x	x
<i>Pegomya affinis</i> (Stein)		x		

* (L) = Larvae.

Table 1 (*continued*)

Organism	Locality			
	Mather		Timberline (Trap)	Mono Lake (Trap)
	Flux	Trap		
<i>Myospila mediotabunda</i> (F.)	x	x		x
<i>Morellia micans</i> (Macq.)		x		
<i>Schoenomyza dorsalis sulfuriceps</i> Mall.		x		
<i>Hylemya alcathoe</i> (Walk.)		x		
<i>Hylemya cilicrura</i> (Rond.)		x	x	x
<i>Hylemya fascialis</i> Mall.	x			
<i>Hylemya</i> sp.		x	x	x
<i>Hylemya cerealis</i> (Gill)			x	x
<i>Coenosia</i> sp.	x			
Lonchaeidae				
<i>Lonchaea</i> sp.				x
Heleomyzidae				
<i>Suillia barberi</i> Darl.			x	
Piophilidae				
<i>Mycetaulus bipunctatus</i> (Fall.)	x			
<i>Piophila (sensu latu)</i> sp.			x	
Lauxaniidae				
<i>Minettia flaveola</i> Coq.	x	x		x
Periscelididae				
<i>Periscelis</i> sp. n.	x			
Aulacigasteridae				
<i>Aulacigaster leucopeza</i> Mg.	x (L)	x		x
Sphaeroceridae (Borboridae)				
<i>Leptocera</i> sp.			x	
COLEOPTERA				
Carabidae				
<i>Holciophorus ater</i> Dej.	x			
Staphylinidae				
<i>Aliochara (sensu latu)</i>	x			
<i>Atheta</i> sp. A.	x			
<i>Atheta</i> sp. B.	x			
<i>Atheta (sensu latu)</i> sp. C	x			
Elateridae				
<i>Melanotus</i> sp.	x			
<i>Limonium humeralis</i> Cand.		x		
Nosodendridae				
<i>Nosodendron californicum</i> Horn	x			
Nitidulidae				
<i>Colopterus truncatus</i> (Rand)	x	x		
<i>Carpophilus discoideus</i> Lec.		x		
<i>Carpophilus hemipterus</i> (Linn.)		x		
<i>Epuraea</i> sp. (<i>terminalis</i> Mann?)		x		

Table 1 (*continued*)

Organism	Locality			
	Mather		Timberline	Mono Lake
	Flux	Trap	(Trap)	(Trap)
Lathridiidae				
<i>Enicmus</i> sp.				
Tenebrionidae				
<i>Eleodes</i> sp.		x		
HYMENOPTERA				
Ichneumonidae				
<i>Zaleptopygus</i> sp. ♂			x	
Pteromalidae				
<i>Halticoptera</i> sp.			x	
Platygasteridae				
<i>Isostasius</i> sp.		x		
Formicidae				
<i>Camponotus vicinus</i> Mayr	x	x		x
<i>Liometopum occidentale</i> Em.	x	x		
<i>Leptothorax rugatulus</i> Em.	x			
<i>Crematogaster</i> sp.	x			
<i>Formica</i> sp. <i>fusca</i> group			x	

near the slime. The ants *Camponotus*, *Liometopum*, and *Leptothorax* were seen in long columns; their paths often disappeared in the crevices of the bark which served as channels for the sap flows. Some insects were collected while they were drinking the sap exudations: *Parcoblatta* (Blattidae), *Gammarotettix* and *Pristoceuthophilus* (Tettigoniidae), *Melanotus* (Elateridae), *Holciophorus* (Carabidae), *Eleodes* (Tenebrionidae), and *Eremocoris* (Lygaeidae).

Within the slime were found adults and larvae of *Nosodendron californicum* (Nosodendridae) (Sokoloff, 1960), many nematodes (unclassified because they were improperly preserved), five families of mites (Tarsonemidae, Canestriniidae, Oribatulidae, Urodinychidae, and Anoetidae), and many Diptera larvae assigned to the following genera: *Bradysia* (Sciaridae), *Megaselia* (Phoridae), *Pericoma* (Psychodidae), *Aulacigaster* (Aulacigasteridae), *Forcipomya*, *Dasyhelea*, and a genus near *Culicoides* (Ceratopogonidae = Heleidae), a genus of Pelopiinae (Chironomidae), and an unidentified muscid pupa. In addition, eggs, larvae, and pupae of *D. pseudoobscura*, *D. persimilis*, *D. victoria*, and *D. californica* have been identified to species by Carson by rearing them to adults.

While some species have been collected only by banana traps and

some only from slime fluxes, the presence of an insect, say, in the trap collection, but absent from the slime flux collection should be given little significance. It may only mean that the insect and the collector did not visit the slime flux at the same time. Thus, for example, *Colopterus discoideus*, *Carpophilus hemipterus*, and *Epuraea* are nitidulids and, requiring sap for feeding and breeding, should have been collected at slime fluxes. Also, among the Drosophilidae, *D. miranda* is closely related to *D. pseudoobscura* and *D. persimilis*. Hence, it probably uses slime fluxes for feeding and breeding. Its absence from the slime flux collection may merely reflect the low population density of this species in the Mather area.

On the other hand, the presence of an insect in association with others at banana traps does not necessarily mean that the two must exploit the same niche: *D. azteca* is the most abundant species at banana traps, outnumbering *D. pseudoobscura* and *D. persimilis*. Were it at all attracted to slime fluxes, it would have been captured even with the crude methods of collection used. Thus, it is fairly certain that *D. azteca* must occupy a niche different from that occupied by *D. pseudoobscura* or *D. persimilis* in the Mather area.

DISCUSSION

With the information presented above, and the food habits of the organisms reported in the literature, it is possible to build a tentative food web as shown in Fig. 3.

The primary source of energy is provided by the tree, which secretes the sap. This liquid, rich in carbohydrates, becomes infected with numerous species of bacteria, yeasts, and fungi. Carson *et al.* (1956) have reported the isolation of several hundred pure cultures of bacteria which remain unidentified. Nothing is known at present of the types of fungi involved in the complex microflora of the slime, but considerable information is available on the various species of yeasts found in the sap exudations of several species of trees and in the crops of *Drosophila*. Thirteen species of yeast have been isolated from the crops of fruit flies and 14 species from oak sap fluxes. It has been noted by Carson and collaborators that the yeasts found in the digestive tract of flies are different from those in exudations of sap where flies were breeding.

On the complex microflora growing in the sap feed larvae of four species of *Drosophila* (*D. pseudoobscura*, *D. persimilis*, *D. victoria*, and *D. californica*) and the adults of these and three more species (*D. subfunnebris*, *D. pinicola*, and *D. busckii*). Other herbivores found in the

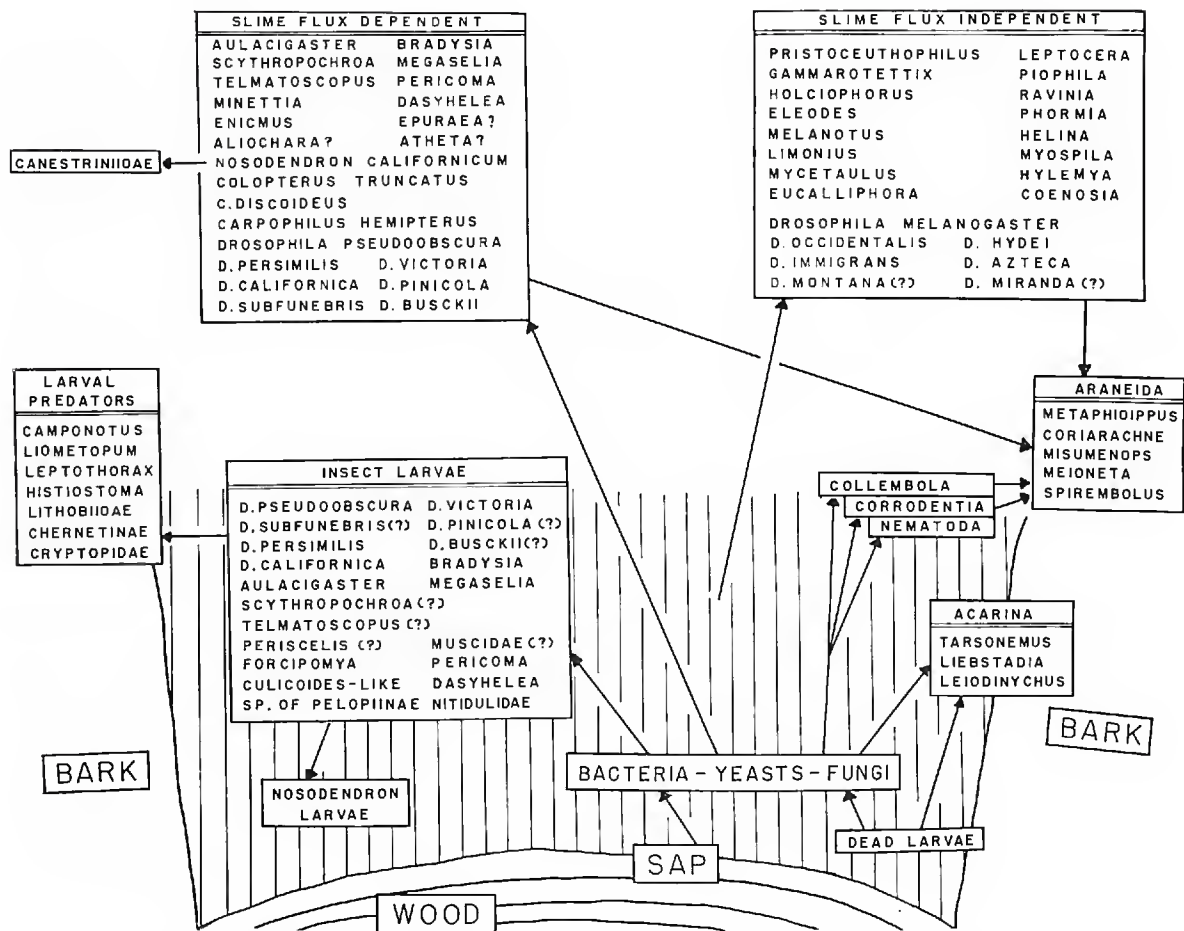


Fig. 3. A tentative scheme of the biocoenosis of *Quercus kelloggii* slime fluxes.

slime include nematodes, Acari (tarsonemid, oribatid, and urodynchid mites), some primitive insects (Collembola and Corrodentia), and families of the more advanced Coleoptera (nitidulids) and Diptera. Although no quantitative data are available, it can be stated that larvae of the dipteran families Sciaridae and Aulacigasteridae are found in large numbers; larvae of *Drosophila*, Phoridae, Psychodidae, and Heleidae are found in much smaller numbers. In addition, adults of all these families and adults of Lauxaniidae, Periscelidae, and Chironomidae have been collected while feeding on the sap of the tree. All these organisms have been entered under the heading of "slime flux dependent" in the figure, but simply for convenience. The habits of these organisms vary, but they have in common the fact that they can exploit the slime flux habitat. Those organisms which obviously occupy other niches during their development but which were apparently present in the flux to replenish fluids have been entered under the heading of "slime flux independent" again purely for convenience. Predators such as spiders belong to the latter category, but they are placed in a separate group in the slime flux biocoenosis to emphasize the fact that both slime flux "dependent" and "independent" forms are used as food.

Although some of the slime flux dependent organisms may prefer to feed on bacteria, others on fungi, and still others on yeasts, the consistency of the slime is such that neither adults nor larvae are able to consume one microorganismic species to the exclusion of all others. It is more likely that both adults and larvae exploit a mixture of these organisms as food. As a result, the various species found in slime fluxes could enter into competitive relationships for the food available. Such events must occur but seldom for *Drosophila*, and only when the microenvironment where eggs and larvae are found is in the process of drying.

This can be the most likely explanation for the following paradoxical situation:

1. *Drosophila* populations can reach a large size. Periodic collections of fruit flies at Mather by Cooper and Dobzhansky from June to September 1954, yielded a total of 42,000 flies of 14 species of *Drosophila* and nearly 1,000 *Aulacigaster* in banana traps. This represents but a small sample of Drosophilidae in the area since collections were not made every day. Of the ten species native to the area, *D. pseudoobscura* and *D. persimilis* were the most abundant after *D. azteca*. We may ignore the last mentioned species, since the slime flux is not its habitat niche.

2. Laboratory studies show that *Drosophila* is a very fecund insect. Under favorable conditions, a single female may produce over a thousand offspring. It would be expected that, if slime fluxes provided similar conditions as a culture bottle, large numbers of larvae would be found in a single slime flux. This expectation fails to materialize: when the slime flux is examined, few larvae (of the order of a few dozen) are found.

3. Other laboratory experiments (for example, Sokoloff, 1955) designed to study intraspecies and interspecies competition at various densities and temperatures have led to the finding that, when competition densities are reached, the weight, hence the size of the flies, drops to the same extent regardless of the temperature conditions. On the other hand, at low densities flies reared at the lower temperature are always heavier.

Now, *Drosophila* captured in nature are much larger than flies reared in vials under severe competition conditions. This suggests that the flies, during their developmental stages, find sufficient food. Putting it in other words: despite the large populations of adults, their high fecundity, and the availability of breeding sites, few females apparently succeed in reaching them to lay their eggs.

It would appear that for *Drosophila* the problem of finding a suitable feeding or oviposition site is far simpler than utilizing it. It has been observed repeatedly by the writer that the larger insects (especially flies) frequenting the slime fluxes exhibit aggressive movements toward the smaller Diptera. The random movements of insects, as observed by Carson and Stalker (1951) in the case of ants, have the same effect. *Drosophila* and other small insects are forced to fly off to another spot of the tree. When this happens repeatedly, the feeding or egg-laying activities of the flies are interrupted.

A further obstacle to adults is presented by spiders. How large a role these animals play in the destruction of fruit flies should not be difficult to ascertain, since some spiders build their webs on the seemingly more attractive part of the slime flux. The net result, however, is that many *Drosophila* females are destroyed before they have an opportunity to lay eggs. Those that escape predation or interference by other members of the biota probably are underfed and lay very few eggs.

Once the eggs are laid, there is no guarantee that they will hatch. It has been observed that some are buried by other larvae and drown in the slime. If the larvae emerge, a further diminution in the population results through the predatory activities of chilopods, pseudoscorpions, mites, ants, adults and larvae of *Nosodendron*, staphylinids, and perhaps other Coleoptera, especially small carabids. In addition, larvae may serve as oviposition sites for some of the small wasps.

Competition, according to Crombie (1947), may be prevented in three ways: by the organism itself, by the physical environment, or by the biotic environment. The first point gains support from the findings by Carson and collaborators (1956) that adults of *Drosophila* utilize one type of slime flux for feeding and another for breeding. Thus, intraspecies competition between larvae and adults of one species does not occur. The second point is sufficiently documented to hold for all insects, since during severe winters or drouth their populations are greatly reduced. The third point needs further substantiation in the case of *Drosophila*. For the present, on the basis of the fauna collected from slime fluxes, the following working hypothesis is suggested: the chief biotic factors responsible for keeping populations of *Drosophila* under control are those organisms identified as predators and associates. Through their activities, they minimize the number of eggs and larvae in a given breeding site and thus make it possible for fruit flies to develop usually with a minimum of competition.

The banana trap must be used with caution in the test of the hypothesis: although many insects have proved to be attracted to both banana

traps and slime fluxes, and many of those recorded so far from baited traps may prove to visit sap exudations, it cannot be assumed that all species will. For example, Carson (1951) has shown that *D. azteca* is about equally abundant as *D. pseudoobscura* and *D. persimilis* in traps, and yet it has never been taken from oak wounds. For this reason, where the habitat niche of *Drosophila* is known, collections of associated biota should be made directly from it. Where the microhabitat occupied by *Drosophila* species is not known, banana traps provide the only method of learning which species *may* coexploit the same breeding and feeding sites, and the feeding habits of these organisms as reported in the literature may help decide whether they are doing so as competitors or as associates. The traps will also show which may be some of the predators of *Drosophila*, since some Hymenoptera and other carnivorous insects are attracted to them.

SUMMARY

1. A preliminary qualitative survey of organisms frequenting slime fluxes (sap exudations infected with microorganisms) of *Quercus kelloggii*, the California black oak, has been carried out in the Mather region of California. A parallel collection has been made with the aid of banana traps at Mather and at two other localities of the Yosemite region.

2. Comparison is made of the adult insect fauna attracted to slime fluxes and banana traps. The conclusion is made that these traps are useful in detecting the forms which may coexploit the same sources of food and some of the predators of *Drosophila* (provided that due consideration is given to the feeding habits of these organisms as reported in the literature) in areas where the habitat niche of species of this genus is unknown.

3. On the basis of the feeding habits of the fauna collected at slime fluxes a tentative food web of the complex biocoenosis of the slime flux is included.

4. The role of these organisms in relation to *Drosophila* is discussed. As a working hypothesis, it is suggested that, of the slime flux biota, predators and associates are the main biotic factors preventing the excessive oviposition by *Drosophila* at the slime flux. As a result, it is probable that competitive relationships between the various organisms associated with *Drosophila* in the exploitation of the slime flux seldom take place.

ACKNOWLEDGMENTS

This study would have been impossible without the generous assist-

ance of the following specialists who classified the material: S. Auerbach: Chilopoda (Lithobiidae, Cryptopidae); E. W. Baker: Acarina (Tarsonemidae, Urodinychidae, Canestriniidae, Oribatulidae, Acaridae); B. D. Burks: Hymenoptera (Pteromalidae); H. P. Dodge: Diptera (Calliphoridae, Sarcophagidae); H. S. Dybas: Coleoptera (Carabidae, Elateridae, Lathridiidae, Nitidulidae, Nosodendridae, Tenebrionidae); R. H. Foote: Diptera (Cecidomyiidae = Itonididae); W. J. Gertsch: Arachnida (Attidae, Linyphiidae, Theridiidae, Thomisidae); A. B. Gurney: Corrodentia (Liposcelidae) and Orthoptera (Blattidae); C. Clayton Hoff: Chelonethida (Chernetidae); H. B. Mills: Collembola (Entomobryidae); C. F. W. Muesebeck: Hymenoptera (Platygasteridae); T. H. Hubbell: Orthoptera (Tettigoniidae); R. D. Hughes: Acarina (Anoetidae); D. H. Kistner and C. H. Seevers: Coleoptera (Staphylinidae); C. W. Sabrosky: Diptera (Piophilidae, Lonchaeidae, Heleomyzidae, Calliphoridae, Lauxaniidae, Muscidae, Sphaeroceridae); M. R. Smith: Hymenoptera: (Formicidae); A. Stone: Diptera (Sciariidae = Lycoriidae, Psychodidae); L. M. Walkley: Hymenoptera (Ichneumonidae); M. R. Wheeler: Diptera (Aulacigasteridae, Drosophilidae, Periscelidae); W. W. Wirth: Diptera (Ceratopogonidae = Heleidae, Phoridae, Syrphidae, Chironomidae = Tendipedidae).

I am also indebted to Mrs. N. P. Dobzhansky, Mrs. Sophie (Dobzhansky) Cole, and Dr. Antonio Brito da Cunha for helping to collect Diptera from traps, and to Dr. Hampton L. Carson for providing me with some arthropods he had collected from slime fluxes. Above all, I wish to express my gratitude to Dr. Th. Dobzhansky who suggested the problem, and to Dr. Jens Clausen for his hospitality at the Mather Station.

This investigation was supported in part by NSF Grant 4501 and USPHS Grants 7842 and 8942.

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Two Scavenger Moths of the Genus *Borkhausenia* Introduced from Europe to the West Coast of North America

(Lepidoptera : Oecophoridae)

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During the past several years specimens of a small, tan moth have appeared commonly in material I have examined from the San Francisco Bay area, and recently light trap collections have produced a related yellow and reddish moth. These represent two species of the genus *Borkhausenia* (*sens. lat.*) which were not recorded in the North American fauna by Clarke (1941).

BORKHAUSENIA (BORKHAUSENIA) FUSCESCENS (Haworth)

One of the first species I encountered when I began collecting microlepidoptera at Berkeley in 1955 was this moth, and it has appeared consistently in houses and at porch lights during subsequent years. *B.*

fuscescens has also turned up in the Sacramento Valley and at San Diego. Its known distribution in California is a reflection of collecting efforts, and I suspect that it is established in most urban areas of the state.

The species was first recorded here as "*Borkhausenia near minutella*" by Armitage (1952), who reported that "for a number of years [specimens of] a small, light tan moth infesting houses in the San Francisco Bay Area have been submitted to Sacramento for identification." The earliest collection data on specimens in the State Department of Agriculture collection at Sacramento are July 1936, at Oakland. Since no specimens were available to J. F. G. Clarke at the time of his revision of North American Oecophoridae (1941), it is logical to assume that the species was not established in California long prior to that. However, Dr. Clarke tentatively identified specimens which I took to Washington in 1959 and stated that the National Museum had no other record of its occurrence in North America.

B. fuscescens is common in England and Scotland and is widespread in Europe from France to Sweden, Central Europe, and Russia (Jacobs, 1950). The moth is small (forewing length: ♂ 4.7 to 6.6 mm; ♀ 5.4 to 8.3 mm) with pale to dark tan forewings usually marked by a variable pair of indistinct darkish spots in the basal third and a large one near the end of the cell. A colored figure of the adult is given by Jacobs. The genitalia are illustrated by Pierce and Metcalfe (1935) and by Toll (1956).

In Europe larvae of *B. fuscescens* have been reported to feed on dead leaves and in birds' nests (Meyrick, 1895; Ford, 1949). The larvae are said to live from September or October to April or May, producing a single annual flight in July and August. In California the species has been reared once, from fungus material, and as suggested by Armitage (1952), *B. fuscescens* probably feeds in mouldy trash or leaves in or around houses. The moths are commonly collected at lights, often in houses, garages, on porches, etc. and have been taken in central coastal California during every month of the year. The climate of this area evidently enables year-round activity, possibly in part due to the species' ability to exist in buildings.

California material examined.—Sonoma Co.: Forestville, 6 ♂, 2 ♀ 12–23 October 1961, at light (R. M. Brown). Yolo Co.: Davis, 1 ♂ 18 July 1956 (J. Powell). Marin Co.: West Novato, 5 ♂, 1 ♀ 4–29 April 1961 (D. C. Rentz); Inverness, 1 ♂ 10 July 1961 (C. A. Toschi). Contra Costa Co.: San Pablo, 1 ♀ 16 March 1959 (Powell), 1 ♂ 23 August 1956 (F. Crisp); El Cerrito, 3 ♂ 19 May to 5 June 1959 (C. D. MacNeill), 1 ♂ 24 July 1963 (D. D. Linsdale); Tilden Park, 1 ♂ 10 September 1962, r. f. *Polyporus adustus* (J. F. Lawrence, lot no. 1102) (P. de

Benedictis); Orinda, 2 ♂ 29 October 1955 (R. H. Goodwin); Pleasant Hill, 1 ♂ 4 April 1957 (W. E. Ferguson); Concord, 1 ♂ 27 September 1961 (R. M. Brown); Walnut Creek, 1 ♂ 30 January 1963, 1 ♀ 7 March 1962, 4 ♂, 2 ♀ 31 March to 13 May 1961 and 1962, 3 ♂, 3 ♀ 29 May to 19 June 1961 and 1962, 1 ♂ 28 July 1961, 1 ♂ 20 August 1962, 7 ♂ 30 September to 22 November 1961 and 1962 (Powell). Alameda Co.: Albany, 1 ♂ 25 June 1957, 1 ♂ 12 September 1957 (Powell); Berkeley, 2 ♀ 21 April 1941 (no collector given), 1 ♂ 26 January 1961 (R. L. Langston), 12 ♂, 3 ♀ 1 March to 10 April 1957–1962 (J. A. Chemsak, Langston, Linsdale, C. W. O'Brien, Powell), 1 ♀ 29 April 1955 (Powell), 1 ♂ 26 May 1961 (Langston), 1 ♀ 15 June 1960, 1 ♂ 29 June 1959 (Powell), 9 ♂, 1 ♀ 19 August to 10 September, 1960–1961 (Langston, Powell, G. I. Stage), 5 ♂ 24 September to 26 October, 1955–1961 (Powell, R. W. Thorp), 1 ♂ 2 December 1958, 1 ♂ 17 December 1960 (Powell); Oakland, 4 ♂, 2 ♀ 29 July 1936 "coll. from house" CDA-36H13 (E. Keal), 1 ♂ 25 February 1952 (R. O. Schuster), 3 ♂ 4 April 1957 (B. J. Adelson); San Lorenzo, 3 ♂ 15 August 1960 (P. D. Hurd, Jr.). San Francisco Co.: San Francisco, 2 ♂ 16 January 1960, 1 ♂ 13 February 1960, 16 ♂, 3 ♀ 29 February to 28 March 1960 (Rentz), 3 ♂ 14 May to 28 June 1960 (H. B. Leech, Rentz). San Mateo Co.: Redwood City, 1 ♂ 24 September 1959, 1 ♂ 27 May 1960 (P. H. Arnaud, Jr.). Santa Clara Co.: New Almaden, 2 ♂ 17, 28 September 1963 (P. A. Opler). San Diego Co.: Del Mar, 1 ♂ 5 August 1959 (R. A. Mackie); La Jolla, 2 ♂, 1 ♀ 18 June 1963 (Powell).

BORKHAUSENIA (BATIA) LUNARIS (Haworth)

In June 1962, light trap collections made by P. D. Hurd, Jr. in Oakland contained numbers of this curious looking little moth, which I had not seen before. Subsequent efforts to determine the extent of its occurrence in this area have resulted in little data. The only records in California I have been able to locate are May 1956 and 1959, in Marin County. Specimens were submitted to me by Trevor Kincaid from Seattle, Washington, so that the species is established at more than one west coast metropolitan area, perhaps due to separate introductions.

In the Old World, *B. lunaris* is common in southern England, and ranges through France, Central Europe, to Sicily and Asia Minor (Meyrick, 1895; Jacobs, 1950). The species appears not to have been reported in North America, and the present records represent recent collections. However, occurrence of the species on two sides of San Francisco Bay, as well as at Seattle, suggests the presence of widespread but local colonies which have not been sampled. A parallel but better documented situation exists with another apparently introduced scavenger moth, *Oinophila v-flava* (Haworth) (Powell, 1964).

B. lunaris is small (forewing length: 4.5 to 5.2 mm) with a shiny appearance and has smooth-scaled, black-and-white head and palpi. The forewing is ochreous yellow, suffused with reddish brown along the costa and termen, with a rather distinct dark blue mark at the tornus.

A colored illustration of the adult is given by Jacobs (1950) (as *Chirocompa lunaris*), and the genitalia are figured by Pierce and Metcalfe (1935) (as *Batia lunaris*) and by Toll (1956), who related *Batia* (= *Chirocompa*) with *Borkhausenia* as a subgeneric entity.

The larvae have been reported to feed in the mouldy and dead wood under the bark of *Acacia*, *Crataegus*, *Malus*, and *Robinia* and are also recorded in wood of baskets, fences, etc. (Ford, 1949; Jacobs, 1950). Pupation is said to take place in the larval feeding site. A single annual generation is listed, the moths flying in June and July and the larvae overwintering. The few North American records indicate a similar life cycle by adventive colonies.

Material examined.—Washington: Seattle, King Co., 7 ♂ 9 to 28 July 1962, 2 ♂ 30 June, 25 July 1963 (T. Kincaid). California: Mill Valley, Marin Co., 2 ♂, 3 ♀ emerged from dead *Ceanothus thyrsiflorus*, 14 May to 14 June 1956, 2 ♀ 21 May, 10 June 1959 (H. B. Leech); Piedmont Pines, NE Oakland, Alameda Co., 40 ♂, 8 ♀ 18 June to 2 July 1962, 15-watt blacklight trap (P. D. Hurd, Jr.).

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A New Genus of Membracidae from China¹

(Homoptera : Membracidae)

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The membracid tribe Hypsauchenini (subfamily Centrotinae) has previously included seven genera, and with the addition of *Notohypsa* includes eight genera. This tribe is rather easily distinguished from other Centrotinae, but confusion could result in the future if some comment were not offered here on the differences between Hypsauchenini and Oxyrhachini (Oxyrhachinae *sensu* Capener, 1962).

The Oxyrhachini have been characterized as having (1) front tibiae foliaceous, (2) head foliaceous, (3) mesonotal scutellum not visible, (4) propleural (ventrolateral pronotal) and mesopleural processes. The Hypsauchenini are also found to have the head foliaceous (variable, but as consistently so as Oxyrhachini), and also to possess the ventrolateral pronotal and mesopleural processes. In addition, the Oxyrhachini as presently defined contains some species with the mesonotal scutellum visible (e.g., *Xiphistes orientalis*), while some members of the Hypsauchenini may have the scutellum concealed (e.g., *Pyrgonota bifurca*). Therefore, of the characters mentioned, we are left only with the foliaceous tibiae to distinguish these two tribes.

Foliaceous is defined by Torre Bueno (1937) as meaning "leaf-like." However, in the membracid literature, "foliaceous" in reference to the head means flat with the ventrolateral margins of the vertex and usually the clypeus broad and expanded to be somewhat leaf-like, but, in reference to the tibiae, "foliaceous" means simply broad and flattened laterally. Most Membracidae have the tibiae flattened laterally, and difficulty may therefore arise as to what constitutes "broad"; however, the tibiae of the Oxyrhachini are 20 per cent to 40 per cent as broad as they are long, while in the Hypsauchenini the tibiae are only 10 per cent to 20 per cent as broad as they are long. Therefore, in general, the tibiae of Oxyrhachini appear "foliaceous" while those of the Hypsauchenini do not.

Another character is available which will immediately distinguish these two tribes. The Hypsauchenini consistently possess a single anterior pronotal horn which in some genera is bifurcate at the tip, while the Oxyrhachini possess either two suprahumeral horns or no anterior pronotal horns.

¹ This work was supported in part by a grant from the Seattle University Research Committee. Specimens for this paper were made available by C. Don MacNeill, California Academy of Sciences.

Nymphs will undoubtedly lend valuable evidence regarding classification when they are better known. The author has only seen nymphs of the new genus *Notohypsa* Cook in the Hypsauchenini, and of the genera *Xiphistes*, *Kambozana*, and *Gongroneura* from Africa (sent by A. L. Capener), and of *Oxyrhachis* from India in the Oxyrhachini. In the nymphs thus far seen, the Hypsauchenini have the pronotum expanded dorsally into a rounded, laterally flattened anterior horn that extends posteriorly to form a posterior node above the mesothorax, and the sixth and seventh abdominal segments bear long curved spines projecting laterally. Nymphs of the Oxyrhachini have an anterior dorsal pronotal horn which is not extended posteriorly, and very small laterally projecting spines on the last several abdominal segments.

KEY TO GENERA OF THE TRIBE HYPSAUCHENINI

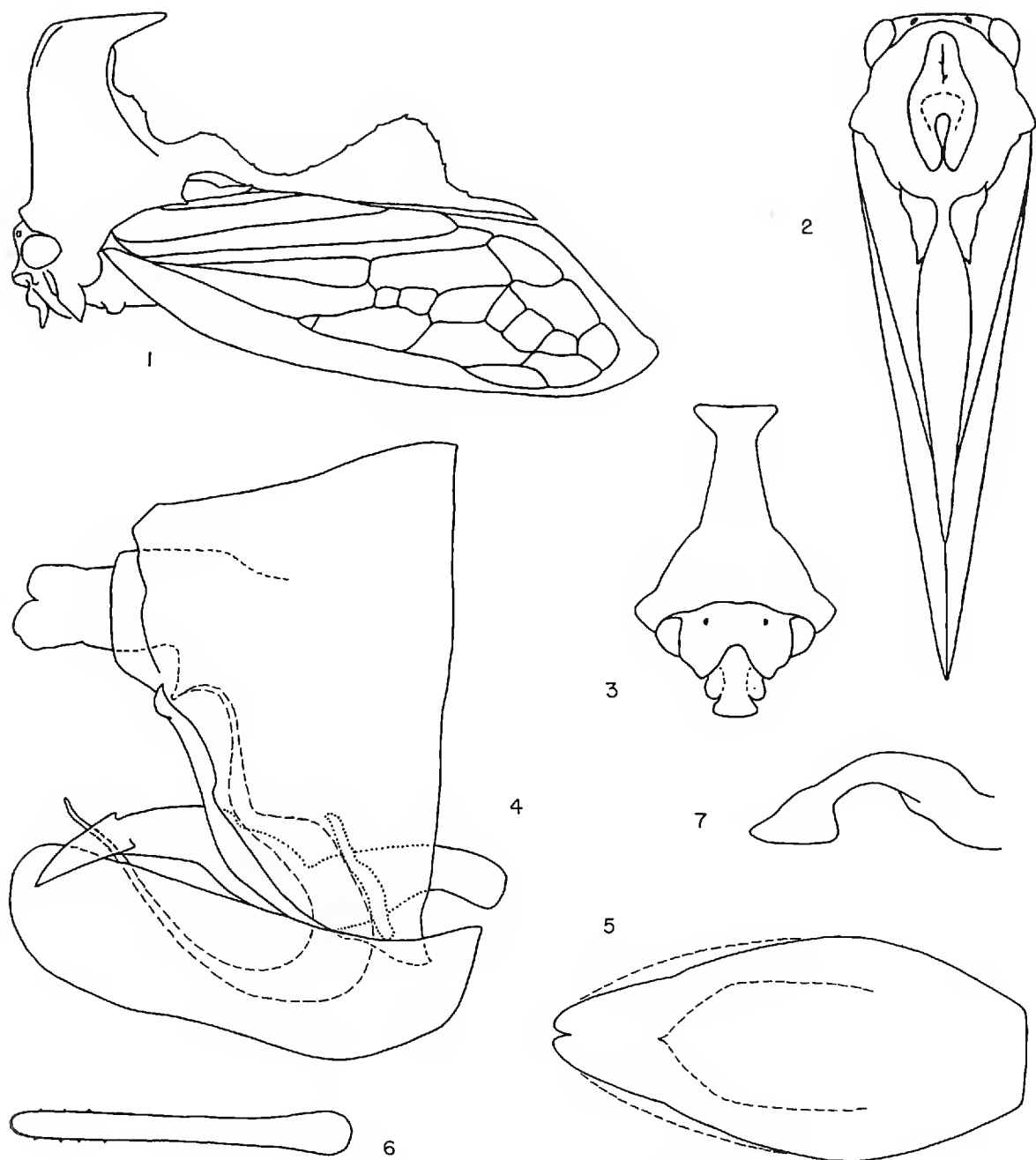
1. Posterior pronotal process with a definite dorsal subapical node 2.
Posterior pronotal process without a definite dorsal subapical node 6.
2. Clypeus extending only slightly below ventral margins of vertex (inferior margins of genae *sensu* Funkhouser) *Gigantorhabdus*
Clypeus extending half or more of its length below ventral margins of vertex 3.
3. Tegmina with five apical and two discoidal cells *Pyrgauchenia*
Tegmina with five apical and three or four discoidal cells, or venation irregular 4.
4. Pronotal horn unbranched, not bifurcate distally *Hypsolyrium*
Pronotal horn bifurcate distally 5.
5. Clypeus single or indistinctly trilobed, base of posterior pronotal process impinging on scutellum so that scutellum is barely visible *Hypsauchenia*
Clypeus distinctly trilobed, the two lateral lobes half the distance from ventral margins of vertex to apex of clypeus, base of posterior pronotal process arched above scutellum *Notohypsa*, n. gen.
6. Anterior pronotal process bifurcate apically and recurved posteriorly .. *Pyrgonota*
Anterior pronotal process unbranched 7.
7. Anterior pronotal process extending upward, bulbous at tip *Funkhouserella*
Anterior pronotal process extending forward, narrowing from base to apex *Hybandoides*

Notohypsa Cook, new genus

Most closely resembling *Hypsolyrium*, but with pronotal horn bifurcate apically, scutellum largely exposed, and more definite venation.

Head.—Broadly foliaceous, about as wide as long, upper margin bituberculate; ocelli farther from each other than from eyes, above centroocular line; clypeus trilobed with apical lobe extending ventrally well beyond lateral lobes, extending about two-thirds its length below ventral margins of vertex (inferior margins of genae *sensu* Funkhouser).

Thorax.—Pronotal horn single, erect, high, laterally flattened, bifurcate at apex; base of posterior process arcuate fully exposing mesonotal scutellum; posterior process bearing a large, laterally flattened, subapical node; ventrolateral exten-



EXPLANATION OF FIGURES

Figs. 1-7. *Notohypsa capeneri* Cook. 1, lateral view. 2, dorsal view; dashed line represents edge of depressed central area. 3, anterior view. 4, lateral view of genital capsule. 5, dorsal view of subgenital plate; outer dashed line represents outline in ventral view, inner dashed line represents inner surface. 6, ventro-posterior view of posterior arm of aedeagus. 7, dorsal view of distal half of right paramere.

sions of pronotum tooth-like and extending ventroposterior to eyes, another adjacent separate smaller tooth-like lobe beneath eye; a ventrolateral tooth also present on mesonotum.

Tegmina.—Coriaceous and punctate basally and along costal margin; five apical and three discoidal cells or venation reticulate; apical limbus average.

TYPE.—*Notohypsa capeneri* Cook.

Notohypsa capeneri Cook, new species

Medium-sized membracids with the anterior pronotal horn upright, laterally concave, bifurcate at the tip, and the head appearing five-lobed due to the broadly expanded lower margins of the vertex and the trilobed clypeus; color stramineous with brown markings, or brown.

Head.—Excluding eyes about as wide as long, upper margin bituberculate, tubercles not strikingly developed and partly covered by frontal margin of pronotum; ecdysial line variable, usually apparent as a vertical carina; ocelli approximately twice as far from each other as from eyes, above centroocular line; lower margins of vertex (inferior margins of genae *sensu* Funkhouser) sinuate, ventrolateral edge turned slightly forward; clypeus trilobed, lateral lobes rounded, ventral lobe broadly truncate and hirsute, clypeus extending ventroposteriorly, about two-thirds its length below ventral margins of vertex, lateral lobes and apex curving ventrally; face stramineous and brown, or brown, lower tips of vertex lightest.

Thorax.—Pronotum laterally flattened, densely punctate, metopidium approximately vertical, frontal margin of pronotum extending forward over head; dorsal anterior horn single, erect, inclined forward but curving slightly backward before bifurcate apex, bifurcations about 0.5 mm long, extending directly posteriorly and curving outward then inward so that apices touch; horn concave laterally, anterolateral margins expanded, irregularly dentate and sometimes nearly carinate, posterolateral margins carinate and irregularly dentate; median carina largely percurrent, irregularly dentate, sometimes partly obsolete on anterior margin of horn; posterior margin of horn sloping posteriorly; base of posterior process arcuate exposing mesonotal scutellum, posterior process nearly or actually impinging on tegmina behind scutellum, bearing a large laterally flattened dorsal subapical node which is approximately two-thirds as high as anterior horn; apex of posterior process acuminate and extending well beyond internal angles of tegmina; pronotum stramineous to brown and sparsely finely pilose; all dentes dark brown; lateral margins of scutellum sinuate; thorax dark brown ventrally.

Abdomen.—Yellow to brown, sometimes marked with red; terga smooth; densely finely punctate.

Tegmina.—Coriaceous and punctate basally and along costal margin with large darker brown punctations scattered along veins, semiopaque with white markings distally; with five or six apical and several discoidal cells, probably basically five apical and three discoidal, but third apical and at least second discoidal subdivided resulting in a somewhat reticulate appearance; apical limbus average in extent, wrinkled.

Measurements:

	Males	Females
Length to tip of posterior process	4.25 to 4.75 mm	5 to 5.75 mm
Length to tips of tegmina	5.25 to 5.75 mm	5.75 to 6.25 mm
Width at humeral angles	1.5 mm	1.75 mm
Height, humeral angle to apex of horn	1.75 to 2 mm	2.25 to 2.5 mm

Male genitalia.—Genital capsule height : length = 5 : 4. Subgenital plate carinate ventrally in basal third, ampliate in distal third, distal two-thirds hirsute; in

ventral view broadest just before middle, narrowing to rounded divided apex; dorsal aspect similar but apparent constriction approximately three-fourths distance from base to apex (grooves to accommodate parameres); outer and inner surfaces continuous but well spaced resulting in cavity between. Lateral valves with small convexity near apex (dorsoposteriorly), the two lateral valves continuous and not divided mesally. Posterior arm of aedeagus very thin (lateral view), about 25 times as long as thickness at middle, arcuate in distal quarter; in posteroventral view ampliate proximally, then nearly parallel-sided to rounded apex, a few (three or four) small teeth projecting laterally from each side in distal third. Parameres fluke-shaped (like fluke of anchor) at apex, in lateral view gently arched from apices to just anterior of middle, the basal portion a partial arch; in dorsal view apices widely divergent, converging anteriorly to just posterior to aedeagus (anterior arm), then diverging anteriorly; hirsute on posterior half except for fluke-shaped apex which is hirsute only on basal ventral surface and naked dorsally.

Holotype male, allotype female, 2 male and 2 female paratypes, all labeled SUISEPA, 1,000 M LICHUAN DISTR. W. HUPEH, CHINA, 16 September 1948. Gressitt and Djou collectors. Holotype, allotype, 1 male and 1 female paratype in the California Academy of Sciences; 1 male and 1 female paratype in the author's collection.

This species is named for A. L. Capener of Pretoria, South Africa.

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A Wasp Parasite of the Possum Tick, *Ixodes tasmani*, in Australia¹

(Hymenoptera : Encyrtidae; Acarina : Ixodidae)

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The encyrtids, an economically important family, parasitize many agricultural pests (especially the Coccidae) and ticks which are vectors of human and other animal diseases. Several genera of these wasps exhibit polyembryony and are interesting from a purely biological standpoint.

Peck (1963) lists only two species of Chalcidoidea known to parasitize ticks in the Nearctic Faunal Region. These species, *Hunterellus hookeri* Howard and *Ixodiphagus texanus* Howard, have a wide geographic distribution (*H. hookeri* is cosmopolitan) and attack many species of ixodid ticks (see Host-Parasite list below). At least three other species are known to use ticks as hosts in other parts of the world. *Ixodiphagus hirtus* Nikolskaya was recovered and described from *Ixodes persulcatus* Schulze in Russia (Nikolskaya, 1950), and *Ixodiphagus mysorensis* Mani was collected and described from *Ornithodoros* sp. from Mysore, India (Mani, 1941). Fiedler (1953) described *Hunterellus theilerae* Fiedler as a parasite of nymphs of *Hyalomma truncatum* Koch in Marienthal District, Southwest Africa, and of *Rhipicephalus oculatus* Neumann in Transvaal, South Africa. Kaiser and Hoogstraal (1958) and Hoogstraal and Kaiser (1961) have reported *H. theilerae* from *Hyalomma marginatum rufipes* on birds migrating from East Africa through Egypt.

Immature *Ixodes tasmani* Neumann were collected from ring-tail possums, *Pseudocheirus peregrinus laniginosus* (Gould), and reared to the adult stages. Although no attempt was made to search for tick parasites, *Ixodiphagus mysorensis* were recovered from two tick collections. The wasps were kindly identified by R. F. Riek of C.S.I.R.O., Canberra, Australia. One collection was made 30 September 1962, at Warramate Hills, Victoria, Australia. Sixteen days later (16 October 1962) eight adult male parasites emerged from an engorged nymphal *Ixodes tasmani* Neumann. The wasps made a circular hole posteroven- trally in the integument of the tick and escaped. The interior of the tick had been completely destroyed and the tick body was filled with exuviae

¹ These observations were made during the tenure of a North Atlantic Treaty Organization (National Science Foundation) Postdoctoral Fellowship spent in the Department of Zoology, University of Melbourne, Australia.

and small brown spheres of wasp frass. The adult male wasps lived only 3 or 4 days at room conditions (approximately 20° C and an unknown, but high, relative humidity).

On 23 April 1963, I collected a partly engorged, nymphal *Ixodes tasmani* from a *Pseudocheirus peregrinus laniginosus*. On dissection of the living nymph I found ten larval hymenopterous parasites. Seven of these were similar in length and size and the other three appeared to be in the initial stages of forming pupae. The parasites were placed in insect saline (Shen's solution) and after 24 hours a transparent, membranous envelope surrounded each parasite. For information relative to the biology and ecology of *Ixodiphagus* and *Hunterellus* consult Wood (1911), Cooley and Kohls (1933), Larson and Green (1938), Clausen (1940), Smith and Cole (1943), Pervomaisky (1947), and Hoogstraal and Kaiser (1961).

The tick host of the second collection was captured 4 miles east of Warburton in the Yarra River Valley, Victoria, Australia, about 20 miles from the area where the infested tick had been found during the preceding spring (October 1962). The immature wasps were not identified, but probably were *Ixodiphagus mysorensis* since they were found in the same host species, in the same type of general habitat, and both occurred 20 miles apart in the Yarra River Valley. In addition to this finding of *I. mysorensis* in Victoria, Australia, in September 1962 and April 1963, R. F. Riek (unpublished) recovered it from nymphs of the wallaby tick, *Haemaphysalis bancrofti* Nuttall and Warburton, in February 1963. Thus, it is evident that this parasite is widely distributed.

The feasibility of using encyrtids as a biological control of ticks is questionable. *Hunterellus hookeri* has been used several times in attempts to control several species of ticks. Cooley and Kohls (1933) reported that the Rocky Mountain spotted-fever tick, *Dermacentor andersoni* (Stiles), was not effectively controlled after releasing millions of parasites in tick-infested areas. In spite of the poor results of the parasite release in the Rocky Mountain region, Smith and Cole (1943) thought it possible that *H. hookeri* might provide a control of *Dermacentor variabilis* (Say) if a colony could be established and maintained by repeated releases. They made such an attempt in 1937, 1938, and 1939 by releasing 90,000 females in two localities on the island of Martha's Vineyard, Massachusetts. No reduction in tick abundance attributable to the wasps was found and, in fact, no wasps were recovered in ticks collected in the area from 1937 to 1942. According to Ushakova (1962), *H. hookeri* were imported from the United States and released in the Leningrad area of Russia in 1935 to control *Ixodes*

ricinus (Linnaeus), but after an encouraging start no positive results were produced. He believed that these failures do not exclude use of local populations of encyrtids against ixodid ticks and that biological control measures are possible with such species as *Haemaphysalis concinna* Koch, *Ixodes persulcatus* Schulze, *Rhipicephalus pumilo* Schulze, *Hyalomma dromedarii* Koch, and others. Unfortunately, Ushakova's (1962) supporting evidence is unconvincing.

HOST-PARASITE LIST

Parasite	Host
<i>Ixodiphagus texanus</i> Howard	<i>Dermacentor variabilis</i> (Say) <i>Haemaphysalis leporis-palustris</i> (Packard) <i>Ixodes cookei</i> Packard <i>I. dentatus</i> Marx <i>I. scapularis</i> Say <i>Rhipicephalus sanguineus</i> (Latreille)
<i>Ixodiphagus hirtus</i> Nikolskaya	<i>Ixodes persulcatus</i> Schulze
<i>Ixodiphagus mysorensis</i> Mani	<i>Ixodes tasmani</i> Neumann <i>Haemaphysalis bancrofti</i> Nuttall and Warburton <i>Ornithodoros</i> sp.
<i>Hunterellus hookeri</i> Howard	<i>Dermacentor andersoni</i> Stiles <i>D. parumapertus</i> Neumann <i>D. variabilis</i> (Say) <i>Haemaphysalis leporis-palustris</i> (Packard) <i>H. concinna</i> Koch <i>Ixodes dentatus</i> Marx <i>I. persulcatus</i> Schulze <i>I. muris</i> Bishopp and Smith <i>I. crenulatus</i> Koch <i>I. scapularis</i> Say <i>I. marmotae</i> Cooley and Kohls <i>Rhipicephalus sanguineus</i> (Latreille) <i>R. pumillo</i> Schulze <i>Hyalomma dromedarii</i> Koch <i>H. japonica douglasi</i> Nuttall
<i>Hunterellus theilerae</i> Fiedler	<i>Hyalomma truncatum</i> Koch <i>H. marginatum rufipes</i> Koch <i>Rhipicephalus oculatus</i> Neumann

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MEETING ANNOUNCEMENT

The annual meeting of the Entomological Society of America will be held 30 November to 3 December at the Benjamin Franklin Hotel, Philadelphia, Pennsylvania.

Type Species of Generic Names Applied to North American Lepturinae

(Coleoptera : Cerambycidae)

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In conjunction with work on the monograph of North American Cerambycidae (National Science Foundation Grant GB2326) much confusion, uncertainty, and error were encountered in determining the valid type species designations of the lepturine genera of North America. Since it is vital to have the proper designations in determining generic concepts, limits, and interpretations, the following is presented in an attempt to clarify the existing situation. No attempts at listing synonyms other than the obvious ones are made in this preliminary analysis of lepturine genera.

1. *Acmaeops* LeConte, 1850. Type species: *Leptura proteus* Kirby (Casey designation, 1913).
Listing by Plavilstshikov (1936) of *Leptura bivittata* Say invalid.
2. *Acmaeopsilla* Casey, 1913. Type species: *Acmaeops falsa* LeConte (monobasic).
3. *Allosterna* Mulsant, 1863. Type species: *Leptura tabacicolor* DeGeer (monobasic).
Allosterna is an improper emendation.
4. *Anastrangalia* Casey, 1924. Type species: *Leptura sanguinea* LeConte (by original designation).
5. *Anisorus* Mulsant, 1863. Type species: *Cerambyx quercus* Goetz (monobasic).
6. *Anoplodera* Mulsant, 1839. Type species: *Leptura sexguttata* Fabricius (Thomson designation, 1864, not Swaine and Hopping, 1928).
7. *Anthophylax* LeConte, 1850. Type species: *Anthophylax viridis* LeConte (Thomson designation, 1864).
Swaine and Hopping (1928) designation of *Leptura malachitica* Haldeman invalid.
8. *Argaleus* LeConte, 1850. Type species: *Argaleus nitens* LeConte (= *Pachyta liturata* Kirby) (Swaine and Hopping designation, 1928).
Synonymy of genotypes makes *Argaleus* a junior synonym of *Pachyta*.
9. *Bellamira* LeConte, 1873. Type species: *Leptura scalaris* Say (monobasic).
10. *Brachyleptura* Casey, 1913. Type species: *Leptura vagans* Olivier (by original designation).
11. *Brachysomida* Casey, 1913. Type species: *Acmaeops tumida* LeConte (by original designation).
12. *Carilia* Mulsant, 1863. Type species: *Leptura virginea* Linnaeus (monobasic).
13. *Centrodera* LeConte, 1850. Type species: *Rhagium decoloratum* Harris (Thomson designation, 1864).

This genus is not monobasic as stated by Swaine and Hopping (1928);

LeConte included two species, *R. decoloratum* Harris and *Toxotus pictus* Haldeman.

14. *Cercolia* Casey, 1913. Type species: *Leptura proxima* Say (by present designation).
15. *Charisalia* Casey, 1913. Type species: *Leptura americana* Haldeman (by original designation).
16. *Choriolaus* Bates, 1885. Type species: *Choriolaus latescens* Bates (by present designation).
17. *Cortodera* Mulsant, 1863. Type species: *Grammoptera spinosula* Mulsant (= *Leptura humeralis* Schaller) (Gressitt designation, 1951).

The designation by Plavilstshikov (1936) of *Leptura humeralis* Schaller is invalid, since this species was not included originally.

18. *Corymbia* Des Gozis, 1886. Type species: *Leptura rubra* Linnaeus (by original designation).
19. *Cosmosalia* Casey, 1913. Type species: *Leptura chrysocoma* Kirby (by original designation).
20. *Cyphonotida* Casey, 1913. Type species: *Ophistomis ventralis* Horn (by original designation).
21. *Desmocerus* Audinet-Serville, 1835. Type species: *Stenocorus cyaneus* Fabricius (= *Cerambyx palliatus* Forster) (monobasic).
22. *Dinoptera* Mulsant, 1863. Type species: *Leptura collaris* Linnaeus (monobasic).
23. *Dorcasina* Casey, 1913. Type species: *Leptura matthewsi* LeConte (by original designation).
24. *Encyclops* Newman, 1838. Type species: *Encyclops pallipes* Newman (= *Leptura caerulea* Say) (monobasic).
25. *Euryptera* Audinet-Serville, 1825. Type species: *Euryptera latipennis* Audinet-Serville (monobasic).
26. *Eutoxotus* Casey, 1913. Type species: *Toxotus schauvi* LeConte (by original designation).
27. *Evodinus* LeConte, 1850. Type species: *Leptura monticola* Randall (monobasic).

Plavilstshikov (1936) and Heyrovsky (1955) have both incorrectly listed *Pachyta liturata* Kirby as the type species of *Evodinus*. This species was not included by LeConte.

28. *Gaurotes* LeConte, 1850. Type species: *Leptura cyanipennis* Say (monobasic).
29. *Grammoptera* Audinet-Serville, 1835. Type species: *Leptura praeusta* Fabricius (Westwood designation, 1840).

Thomson's (1864) designation of *Leptura lurida* Fabricius is invalid, as is the selection of *Leptura ruficornis* Fabricius by Plavilstshikov (1936), Gressitt (1951), and Heyrovsky (1955).

30. *Hapolosalia* Casey, 1913. Type species: *Leptura vibex* Newman (by original designation).
31. *Idiopidonia* Swaine and Hopping, 1928. Type species: *Leptura pedalis* LeConte (monobasic and by original designation).
32. *Judolia* Mulsant, 1863. Type species: *Leptura 6-maculata* Linnaeus (Casey designation, 1913).
33. *Leptacmaeops* Casey, 1913. Type species: *Leptura longicornis* Kirby (by original designation).

34. *Leptalia* LeConte, 1873. Type species: *Anoplodera macilenta* Mannerheim (by original designation).
35. *Leptorhabdium* Kraatz, 1879. Type species: *Xylosteus gracilis* Kraatz (monobasic).
36. *Leptura* Linnaeus, 1758. Type species: *Leptura 4-fasciata* Linnaeus (Westwood designation, 1840).

The genotype designations by Latreille (1810) of *Rhagium mordax* Fabricius, and by Curtis (1831) of *Leptura elongata* DeGeer, are invalid because neither of these were included originally by Linnaeus. Thomson's (1860, 1864) designation of *Leptura virens* Linnaeus is also invalid because of the prior fixation by Westwood (1840). In 1886, Des Gozis improperly selected *Leptura melanura* Linnaeus as the type species and subsequently Plavilstshikov (1936) and Heyrovsky (1955) erroneously listed *Leptura rubra* Linnaeus as the genotype.

37. *Megaleptura* Casey, 1913. Type species: *Leptura emarginata* Fabricius (by present designation).
38. *Microrhabdium* Kraatz, 1879. Type species: *Microrhabdium macilentum* Kraatz (monobasic).
39. *Nakanea* Ohbayashi, 1963. Type species: *Leptura vicaria* Bates (by original designation).
40. *Necydalis* Linnaeus, 1758. Type species: uncertain.

The question of type species of *Necydalis* and *Molorchus* has not been resolved.

41. *Neobellamira* Swaine and Hopping, 1928. Type species: *Strangalia delicata* LeConte (by original designation).
42. *Neogaurotes* Podany, 1962. Type species: *Leptura virginea* Linnaeus (by original designation).

This name becomes a junior synonym of *Carilia* Mulsant by virtue of isogenotypy.

43. *Neoleptura* Thomson, 1860. Type species: *Neoleptura lecontei* Thomson (monobasic).
44. *Nivellia* Mulsant, 1863. Type species: *Leptura sanguinosa* Gyllenhal (monobasic).
45. *Ophistomis* Thomson, 1857. Type species: *Ophistomis flavocinctus* Thomson (monobasic).

Thomson included no valid species when this name was first proposed. Subsequently (1860), he assigned *O. flavocinctus* to the genus.

46. *Ortholeptura* Casey, 1913. Type species: *Ortholeptura oculatea* Casey (by original designation).
47. *Oxymirus* Mulsant, 1863. Type species: *Cerambyx cursor* Linnaeus (monobasic).
48. *Pachyta* Dejean, 1821. Type species: *Leptura 8-maculata* Fabricius (= *4-maculata* Linnaeus) (Westwood designation, 1840).

Thomson (1864) invalidly designated *Leptura 4-maculata* Linnaeus as the type species and Plavilstshikov (1936) and Heyrovsky (1955) incorrectly listed *Cerambyx lamed* Linnaeus.

49. *Paragaurotes* Plavilstshikov, 1921. Type species: *Gaurotes ussuriensis* Blessig (by original designation).

50. *Parallelina* Casey, 1913. Type species: *Leptura molybdica* LeConte (by original designation).
51. *Parapachyta* Casey, 1913. Type species: *Pachyta spurca* LeConte (by original designation).
52. *Pidonia* Mulsant, 1863. Type species: *Leptura lurida* Fabricius (Swaine and Hopping designation, 1928).
53. *Piodes* LeConte, 1850. Type species: *Piodes coriacea* LeConte (monobasic).
54. *Pseudogaurotina* Plavilstshikov, 1958. Type species: *Gaurotes splendens* Jakowleff (by original designation).
55. *Pseudopachyta* Swaine and Hopping, 1928. Type species: *Toxotus rugipennis* Newman (monobasic and by original designation).
56. *Pseudostrangalia* Swaine and Hopping, 1928. Type species: *Leptura cruentata* Haldeman (monobasic and by original designation).
57. *Pyrotrichus* LeConte, 1862. Type species: *Pyrotrichus vitticollis* LeConte (monobasic).
58. *Rhagium* Fabricius, 1775. Type species: *Cerambyx inquisitor* Linnaeus (Curtis designation, 1839).

The confusion existing in the usage of the names *Rhagium* and *Stenocorus* has resulted from the original proposal of *Stenocorus* by Geoffroy (1762) to include the group of species placed into *Rhagium* by Fabricius. With the subsequent invalidation of Geoffroy's work, *Rhagium* becomes distinct from *Stenocorus*.

Swaine and Hopping (1928) misinterpreted the situation and synonymized *Rhagium* with *Stenocorus* and designated *Cerambyx inquisitor* Linnaeus as the type species. Plavilstshikov (1936) and Heyrovsky (1955) incorrectly list *Rhagium bifasciatum* Fabricius as type species.

The genera *Hargium* Samuella, 1819 and *Allorhagium* Kolbe, 1884 are synonyms of *Rhagium* by reason of isogenotypy.

59. *Sachalinobia* Jacobson, 1899. Type species: *Sachalinobia retata* Jacobson (monobasic and by original designation).

S. retata is a junior synonym of *S. koltzei* Heyden.

60. *Stenocorus* Fabricius, 1775. Type species: *Leptura meridiana* Linnaeus (Plavilstshikov designation, 1936).

Since the work of Geoffroy (1762) has been placed on the Official Index of Rejected and Invalid Works by the International Commission on Zoological Nomenclature (Opinion 228, 1954), the generic name *Stenocorus* must be used in the sense of Fabricius (1775).

The designation of *Stenocorus parisinus* Fourcroy by Thomson (1864) as the type species of *Stenocorus* is invalid since that species was not in Fabricius' original list.

Swaine and Hopping (1928) designated *Cerambyx inquisitor* Linnaeus as the type of the genus which cannot be accepted since that species was included under *Rhagium* by Fabricius.

Plavilstshikov (1936) correctly designated *Leptura meridiana* Linnaeus as type species of *Stenocorus*.

In 1953 Gressitt presented some notes on nomenclature of Lepturinae in which he stated that the subgenus *Stenocorus* (s. str.) reverts to *Allorhagium*. This conclusion cannot be accepted since both the nominate subgenus and *Allorhagium* are isogenotypic.

The names *Toxotus* Dejean and *Minaderus* Mulsant become junior synonyms of *Stenocorus* by isogenotypy.

61. *Stenostrophia* Casey, 1913. Type species: *Leptura tribalteata* LeConte (by original designation).
62. *Stenura* Dejean, 1837. Type species: *Leptura emarginata* Fabricius (by present designation).

This type designation makes *Megaleptura* Casey a synonym of *Stenura* by reason of isogenotypy.

63. *Stictoleptura* Casey, 1924. Type species: *Leptura cribripennis* LeConte (by original designation).
64. *Strangalepta* Casey, 1913. Type species: *Leptura vittata* Olivier (by original designation).
65. *Strangalia* Audinet-Serville, 1835. Type species: *Leptura luteicornis* Fabricius (Thomson designation, 1864).

Westwood (1840) designated *Leptura elongata* DeGeer as type species. This selection was invalid since that species was not in the original list, even though *elongata* DeGeer and *calcarata* Fabricius (name included by Serville) are junior synonyms of *maculata* Poda. Westwood did not synonymize *elongata* at the time of his type designation.

Des Gozis (1886) designated *Leptura attenuata* Linnaeus (not *rubra* as stated by Swaine and Hopping, 1928) as the type of *Strangalia*, but Thomson's prior designation takes precedence.

Aurivillius (1912) unnecessarily proposed the replacement name *Strangalina* for *Strangalia* and Swaine and Hopping designated *Leptura attenuata* Linnaeus as the type species.

66. *Strangalina* Aurivillius, 1912. Type species: *Leptura attenuata* Linnaeus (Swaine and Hopping designation, 1928).
67. *Strophiona* Casey, 1913. Type species: *Leptura laeta* LeConte (by original designation).
68. *Thesalia* Casey, 1891. Type species: *Acmaeops lisa* Leng (monobasic).
69. *Tomentgaurotes* Podany, 1962. Type species: *Gaurotes batesi* Aurivillius (by original designation).
70. *Toxotochorus* Reitter, 1907. Type species: *Toxotus tataricus* Gebler (monobasic).
71. *Toxotopsis* Casey, 1913. Type species: *Leptura cinnamoptera* Randall (monobasic).
72. *Toxotus* Dejean, 1821. Type species: *Leptura meridiana* Linnaeus (Westwood designation, 1840).

This genus is isogenotypic with *Stenocorus* Fabricius.

73. *Trachysida* Casey, 1913. Type species: *Leptura mutabilis* Newman (by original designation).
74. *Trigonarthris* Haldeman, 1847. Type species: *Leptura proxima* Say (monobasic).
75. *Typocerus* LeConte, 1850. Type species: *Leptura zebrata* Fabricius (Thomson designation, 1860).

The designation by Casey (1913) of *Leptura velutina* Olivier is invalid.

76. *Ulochaetes* LeConte, 1854. Type species: *Ulochaetes leoninus* LeConte (monobasic).
77. *Vadonia* Mulsant, 1863. Type species: *Leptura unipunctata* Fabricius (Fairmaire designation, 1864).

78. *Vesperoctenus* Bates, 1891. Type species: *Vesperoctenus flohri* Bates (monobasic).
79. *Xestoleptura* Casey, 1913. Type species: *Xestoleptura corusca* Casey (by original designation).
80. *Xylosteus* Frivaldszky, 1838. Type species: *Xylosteus spinolae* Frivaldszky (monobasic).

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Notes on Two Sphecinae Described by Fox

(Hymenoptera : Sphecidae)

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Recently Dr. G. Wallace of the Carnegie Museum in Pittsburgh sent me some Sphecinae wasps for determination. Included in the lot were syntypes of two species described by Fox. I am selecting lectotypes for both and describing features not adequately covered by Fox in the original descriptions.

ISODONTIA (ISODONTIA) LAEVIPES (Fox)

Sphex laevipes Fox, 1897. Proc. Acad. Nat. Sci. Philadelphia, 1897: 375. Lectotype ♂, Uacarizal (Uacurizal, Mato Grosso, Brazil?). Carnegie Museum. Present designation.

MALE.—Length 17 mm; antenna, head, scutum, scutellum, postscutellum, mesosternum, profemur, and gaster black; remainder of body reddish brown except for black tints on pronotal collar and on the mesofemora and metafemora and tibiae; leading margin of forewing infumate, remainder clear, veins brown; erect hair of body pale; face, pronotal collar, and lateral propodeal stripe of silver appressed hair; no sternal ciliate bands; flagellomere I slightly shorter than II and III combined; flagellomeres IV and V with narrow fossulae; free margin of clypeus with a broad, deep emargination; petiole longer than metatarsal segment I; aedeagus and sternite VIII as in Figs. 2 and 3, respectively; second submarginal cell about as high as wide.

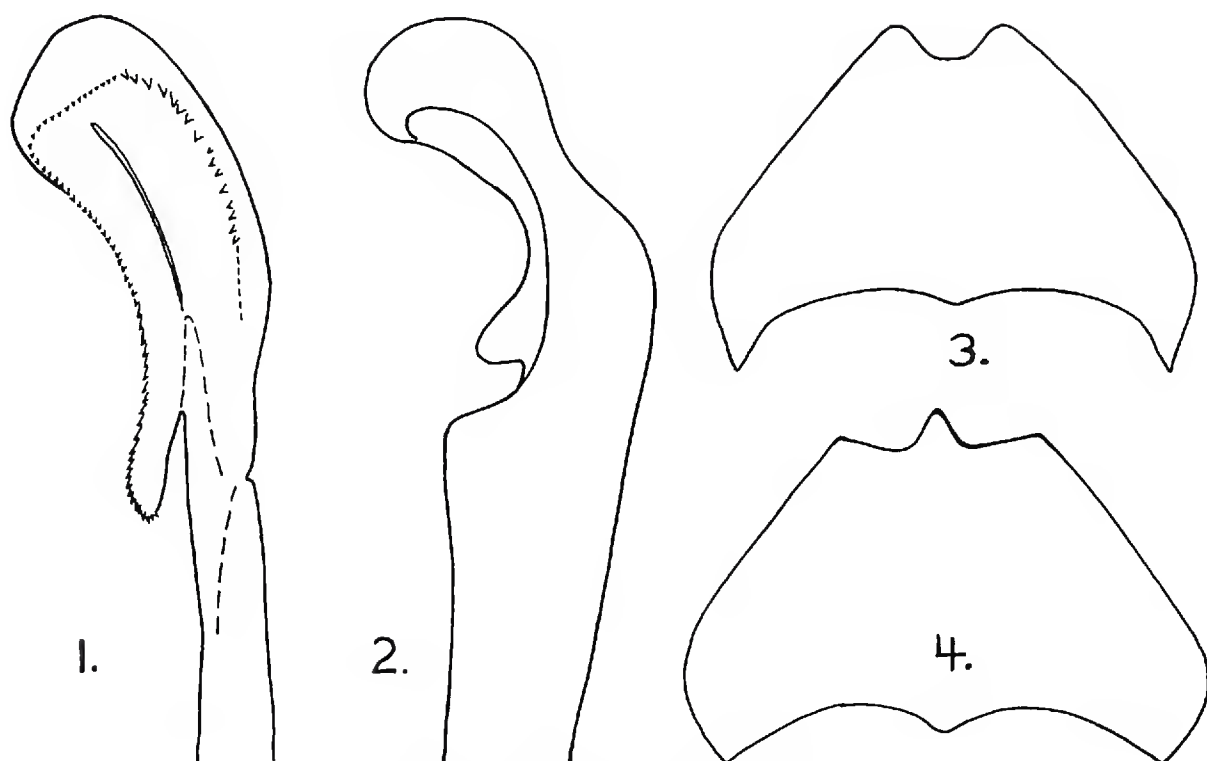
FEMALE.—Length 17 mm; body black except for following reddish areas: proximal end of petiole, and inner surfaces of middle and hind legs; pubescence as in male; forewing more broadly and strongly infumate than in male; free margin of clypeus truncate but with a small median impressed lip.

Fox listed one male and three females in his description but only one male and one female could be found in the Carnegie collection. The one female examined is from Chapada (Chapada dos Guimaraes, Mato Grosso). This species belongs in the fuscipennis group outlined by Bohart and Menke (1963: 133). The aedeagus and the emarginate male clypeus are distinctive in *Isodontia laevipes*. The impressed clypeal lip in the female appears to be the only feature which readily separates this species from female *Isodontia fuscipennis*. *I. laevipes* is known only from the types.

SPHEX FERRUGINEIPES Fox

Sphex ferrugineipes Fox, 1897. Proc. Acad. Nat. Sci. Philadelphia, 1897: 377. Lectotype ♂, Chapada (dos Guimaraes, Mato Grosso, Brazil). Carnegie Museum. Present designation.

MALE.—Length 18 mm; head, thorax, petiole, coxa, black; mandibles, free margin of clypeus, tegula, gaster, trochanter, femur, tibia, and tarsus, red; wings



EXPLANATION OF FIGURES

Figs. 1 and 2, aedeagus, profile at apex, of *Sphex ferrugineipes* and *Isodontia laevipes*, respectively. Figs. 3 and 4, outline of male sternite VIII of *I. laevipes* and *S. ferrugineipes*, respectively.

clear; erect hair pale; face with appressed silver hair; lobe and collar of pronotum, tegula, scutal furrows, postscutellum, propodeum at petiole socket, mesopleura behind pronotal lobe, pleural spot at mesocoxa and weak stripe along anterior margin of stigmatal groove, and forecoxa with appressed silver hair; flagellomeres IV–VI with moderately broad fossulae; gastral sternites IV–VII with transverse bands of pale cilia; sternite VIII as in Fig. 4; aedeagus as in Fig. 1.

FEMALE.—Average length 20 mm; markings and pubescence as in male.

Fox described this species from three females and ten males but three of the males could not be found.

This species is very similar to *S. ichneumoneus* (Linnaeus) and *S. dorsalis* Lepeletier; however, *S. ferrugineipes* is not as densely nor as extensively pubescent as these two species. In addition, the hair color is usually deep golden in *S. ichneumoneus* and *S. dorsalis* while in *S. ferrugineipes* it is silver. The three fossulae on the antenna of *S. ferrugineipes* readily separate this species from male *S. dorsalis* which only have two. The aedeagus and subgenital plate will separate *S. ferrugineipes* males from *S. ichneumoneus* males. For comparison the aedeagi of *S. ichneumoneus* and *S. dorsalis* are figured by Bohart and Menke (1963). See Figs. 75 and 81 (misabeled *nudus*) for *S. dorsalis* and Fig. 83 for *S. ichneumoneus*. The male antennae of these two species are also illustrated by Figs. 90 and 92.

Females of *S. ferrugineipes* are more difficult to identify. The clypeus of *S. dorsalis* females is keel-like or carinate dorsally along the midline whereas female *S. ferrugineipes* and *S. ichneumoneus* have a flattened clypeus dorsally. The dense golden pubescence will help to separate *S. ichneumoneus* females from the silver-haired *S. ferrugineipes*. Both *S. ichneumoneus* and *S. dorsalis* females can have a completely red gaster; however, they commonly have a few black gastral segments in contrast to the all-red gaster of *S. ferrugineipes*. Some of the males of *S. ferrugineipes* have black areas on the gastral tergites.

The six male and three female lectoparatypes are from Chapada. Fox also gave Corumbá as a type locality.

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MEETINGS OF THE PACIFIC COAST ENTOMOLOGICAL SOCIETY

The Pacific Coast Entomological Society holds four or five meetings each year. A lecture is planned for each meeting. Members and visitors are always welcome to attend and to present short notes of entomological interest. When accompanied by a manuscript, these notes are published in the Proceedings of the Society which appear in the January issue. All members in good standing may receive notices of the meetings by requesting the Secretary to place their names on the mailing list.

Descriptions of Five New Trichoptera

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The five new species described in this paper represent very interesting additions to the trichopterous fauna of the United States. The new *Anagapetus* represents the fifth species in this typically western genus. Two new species of *Polycentropus* are described, one from North Dakota and one from California. One new *Lepidostoma* is added to the rich western fauna of that genus. The peculiar limnephilid genus *Cryptochia* is rarely collected and is known only from three western species; a fourth species, from California, is described herein. In many respects this new *Cryptochia* presents interesting departures from the previously described species.

Unless stated otherwise, types of the new species are in the collection of the author.

Anagapetus aisha Denning, new species

This species is closest to *A. chandleri* Ross; it differs from that species in lacking the lateral projection of the ninth tergite, and the apex of the clasper having no ventral process.

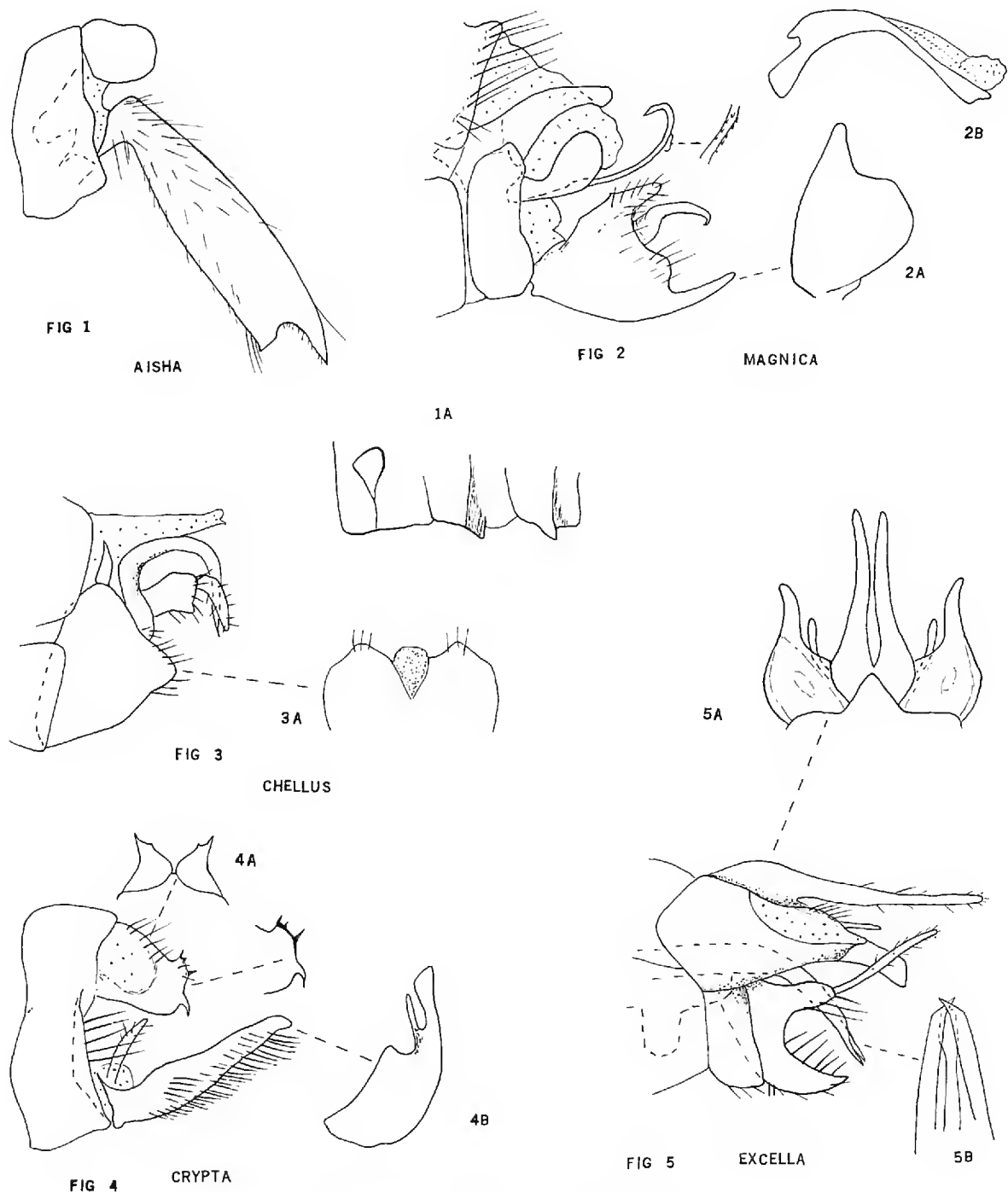
MALE.—Length 7 mm. Wings uniformly dark brown, no pattern, pubescence sparse. Head, thorax, abdomen brown, appendages flavous, antenna (broken) about same color as thorax. Fifth, sixth, and seventh sternites all transversed by a dark sclerotized band; fifth sternite with a lateral semicircular protrusion joined to each by the transverse band; sixth sternite with a mesal process, prominent and triangular; seventh sternite bearing a prominent mesal process, truncate from caudal view and conical from lateral aspect (Fig. 1A).

Genitalia as in Fig. 1. Tenth tergite divided into a pair of lateral lobes, broadly rounded, no projections, setation very sparse. Claspers greatly elongated, flat, wide, and slightly concave, abruptly curved ventrocaudad; apex with an acuminate dorsal lobe and an extremely short truncate ventral projection; except for basal half, setation sparse, along dorsal margin a dense mass of dark brown minute setae are located. Aedeagus small, hidden within ninth segment.

Holotype male.—KINGS CANYON NATIONAL PARK, FRESNO COUNTY, CALIFORNIA, elevation 6,400 feet, 4 June 1963, C. P. Alexander.

Polycentropus magnica Denning, new species

This new *Polycentropus* is the largest species described from North America. Although distinctive, its relationship to other described species has not been determined, it would appear to be unique among our known polycentropids.



EXPLANATION OF FIGURES

Figs. 1-5. 1, *Anagapetus aisha*, lateral aspect; 1A, fifth, sixth, seventh sternites, lateral aspect. 2, *Polycentropus magnica*, lateral aspect; 2A, clasper, ventral aspect; 2B, aedeagus, lateral aspect. 3, *Polycentropus chellus*, lateral aspect, 3A, fused claspers, ventral aspect. 4, *Lepidostoma crypta*, lateral aspect; 4A, tenth tergite, dorsal aspect; 4B, clasper, ventral aspect. 5, *Cryptochia excella*, lateral aspect; 5A, ninth and tenth tergite, dorsal aspect; 5B, aedeagus and aedeagus blades, ventral aspect.

MALE.—Length 15 mm. Color of wings uniformly light brown except for a few scattered white areas in the forewing, dark brown pubescence fairly abundant. Head and thorax varying shades of dark brown and yellow. Antennae yellowish, segments outlined with black. Legs and spurs yellow, pubescence dark brown. Fifth sternite with a circular glabrous area, arising from mesal surface near center

is an elongate membranous sac whose function is unknown; this peculiar development has not been described previously.

Genitalia as in Fig. 2. Ninth sternite elongate, narrow, articulated to ninth tergite which extends dorsocaudad, narrowed distally to an ovate apex, lateral portion flared outward, concave beneath. Tenth tergite membranous, irregular in outline. Cerci narrowed basally, distal portion orbiculate, from the ventral corner arise a pair of prominent filamentous processes, divergent from base to apex, distal half armed with rows of spicules. Claspers large, mesal surface concave; dorsal angle thumb-like, the ventral corner elongated and curved slightly dorsad; distal margin near dorsal lobe gives rise to an acuminate process curved mesad. From ventral aspect (Fig. 2A), ventral margin of claspers slightly divergent, ventral lobe large, gradually narrowed to an obtuse apex. Aedeagus long, slender, arcuate; ventral sclerotized portion trough-like, from caudal view apex quadrate; a large membranous lobe occupies distal portion, Fig. 2B.

Holotype male.—YOSEMITE NATIONAL PARK, FRESNO COUNTY, CALIFORNIA, 8 September 1963, D. G. Denning.

Polycentropus chellus Denning, new species

This species is related to the *interruptus-flavus* group, it differs from each in the broadly triangular claspers and their ventrally fused condition, by the short, curved tenth tergite and the digitate apical segment of the clasper.

MALE.—Length 8 mm. Wings fuscous, pubescence causing indistinct markings near apex; head, thorax, abdomen dark brown; appendages and antennae brown. Fourth sternite bears a broad flat process arising from dorsocephalad corner which gradually tapers to a caudad-curved apex, and extends to the dorsal margin of fourth tergite.

Genitalia as in Fig. 3. Ninth tergum membranous, extended caudad about as far as cercus. Filaments of tenth tergite arched ventrad, long, acuminate, the acute apex reaching ventrad slightly beyond cercus. Cercus with basal segment gradually widened distally, distal margin truncate; apical segment digitate, curved ventrad. Claspers occupy most of capsule, broadly triangular from lateral aspect; arising from dorsal angle and associated with the base of the ninth tergum is a pair of long, narrow acute sclerites. It is not clear if this sclerite is a part of the ninth tergum or an extension of the clasper. From ventral aspect (Fig. 3A), the claspers are fused along meson, fusion discernible by a darkly sclerotized line; between apices arise a short truncate process which is probably all that remains of the eighth sternum.

Holotype male.—FARGO, NORTH DAKOTA, light trap, 1 August 1956.

Lepidostoma crypta Denning, new species

This species is a member of the *pluvialis* group and is probably closest to *L. rayneri* Ross. Distinguishing characters are in the peculiar configuration of the tenth tergite and the distal portion of the clasper.

MALE.—Length 7 mm. Front wing fulvous, entire costal cell reflexed, the re-

sultant pocket filled with a dense mass of dark brown setae. Antennal scape long, slender, mesal margin thickly haired, no modifications. Head and thorax light brown. Legs yellowish, spurs 2-4-4 with no modifications. Maxillary palpus apparently one segmented, bearing a dense brush of brown hairs distally.

Genitalia as in Fig. 4. Ninth segment annular, caudal margin of ninth sternite produced slightly laterad to form a long narrow invagination. Tenth tergite separated on meson and thus divided into two lateral lobes (Fig. 4A), from lateral aspect distal margin bearing a prominent ventrad directed spine, apicodorsal corner produced into a crown-like series of several minute spines; from dorsal aspect (Fig. 4A) ninth tergite apical lobe obtuse, tenth tergite lateral lobes acute and divergent distally. Clasper slender, long, ventral portion heavily clothed with long, light brown setae, basodorsal lobe digitate; from ventral aspect (Fig. 4B) a slender distally acute lobe is present near apex along mesal margin. Aedeagus tubular, arcuate, bearing a pair of long, closely appressed, very slender acuminate rods.

Holotype male.—SCOTT MOUNTAIN, 19 AIR MILES NORTH OF TRINITY CENTER, TRINITY COUNTY, CALIFORNIA, 5,300 feet, 5 July 1963, C. D. MacNeill and V. B. Whitehead. The type is to be deposited in the collection of the California Academy of Sciences, Golden Gate Park, San Francisco, California.

***Cryptochia excella* Denning, new species**

This new species represents the fourth species in the genus, all the described species are known only from the Western region. *C. excella* represents the most complex species thus far described in the genus, secondary modifications of the male genitalia have proceeded further than in *C. pilosa*, *C. furcata*, and *C. neosa*. This new species may be separated from other members of the genus by the development of the ninth segment, the rudimentary remains of the cercus, the absence of large secondary developments of the aedeagal structure, and several other details.

MALE.—Length 8 mm. Wings blackish, pubescence sparse. Head and thorax varying shades of yellow to dark brown, setation golden, antennae dark brown, legs yellowish.

Genitalia as in Fig. 5. Division between ninth tergum and sternum distinct; ninth sternum narrow, band-like; ninth tergum very large, it merges imperceptibly into a large circular membranous area in which all that remains of the semimembranous cercus is located, the distal portion is fused to the ventral lobe of the tenth tergite which thus appears to be derived from it. Tenth tergite from lateral aspect (Fig. 5) slender and elongate, the ventral portion bearing a dorsal filamentous lobe and a large apically truncate ventral lobe; from dorsal aspect (Fig. 5A) cleft almost to base, each lateral lobe elongate and only slightly divergent. Clasper somewhat crescent-shaped, dorsal lobe bears a long prominent filamentous process, ventral lobe narrowed and curved dorsad; basal portion of claspers fused to ventral margin of aedeagus blades. Aedeagus consists of a pair of heavily sclerotized blades, curved ventrad distally, apex flattened and acute; basal portion developed

ventrad as a sclerotized ovate structure within the eighth sternum; from ventral aspect (Fig. 5B) apices taper suddenly to an acute apex and cross distally; the true aedeagal structure is semimembranous, located between the two blades and is discernible only from ventral or dorsal aspect.

Holotype male.—KING'S CANYON NATIONAL PARK, FRESNO COUNTY, CALIFORNIA, 6,400 feet, 4 June 1963, C. P. Alexander.

The described species of *Cryptochia* may be separated in the following key:

KEY TO SPECIES BASED ON MALES

1. Tenth tergite lateral lobe developed into a long and narrow lobe, filamentous process of clasper long 2
 Tenth tergite lateral lobe long and wide, filamentous process of clasper short 3
2. Ninth tergum large and elongated, aedeagus with a short ventral process near base *excella*
 Ninth tergum normal, not elongated, aedeagus with a massive boot-like structure *pilosa*
3. Ventral process of aedeagus as long as dorsal blades, apex hamate *furcata*
 Ventral process of aedeagus half the length of the dorsal blades, apex truncate *neosa*

The known distribution of the members of *Cryptochia* is as follows:

Cryptochia pilosa (Banks), Washington, Oregon, Idaho, and British Columbia.

Cryptochia neosa Denning, known from the type locality only, Blue Mountains, Grant County, Oregon.

Cryptochia furcata Denning, Montana and British Columbia. A new distributional record is available from Mt. Rainier National Park, Washington, 22 July 1954, Borys Malkin, 1 ♂, 1 ♀.

Cryptochia excella Denning, type locality only, King's Canyon National Park, California.

The author would like to express his appreciation and thanks to Dr. C. P. Alexander, Amherst, Massachusetts, and to Mr. MacNeill and Mr. Whitehead of the California Academy of Sciences for collecting several of the new species described in this paper.

New Species of the Genus *Dorylocratus* with Notes
on Their Behavior¹
(Coleoptera : Staphylinidae)

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The genus *Dorylocratus* Wasmann was recently redescribed and its phylogenetic affinities with *Dorylomimus* Wasmann and *Jeanneliusa* Bernhauer were documented by Seevers (1964). It is therefore the purpose of this paper to redescribe the only previously known species and to describe two new species, one of which was collected recently in Liberia and another based on a specimen in the collections of the Musée Royal de l'Afrique Centrale, Tervuren, which was formerly determined as *Dorylocratus rex* Wasmann. Specimens of this genus are rare in collections and seem to be rare in nature also. For this reason the small number of behavioral notes we were able to record will be given here.

ACKNOWLEDGMENTS

The author wishes to thank Mr. P. Basilewsky, Curator and Chief of the Entomology Section of the Musée Royal de l'Afrique Centrale, Tervuren, for the loan of the specimen which formed the basis of *D. kisantuensis* Kistner, n. sp., Professor J. K. A. Van Boven, Université de Louvain, for the determination of the ants, and Mr. Al Muto, Chico State College, for the translation of the Patrizi (1951) paper from Italian to English.

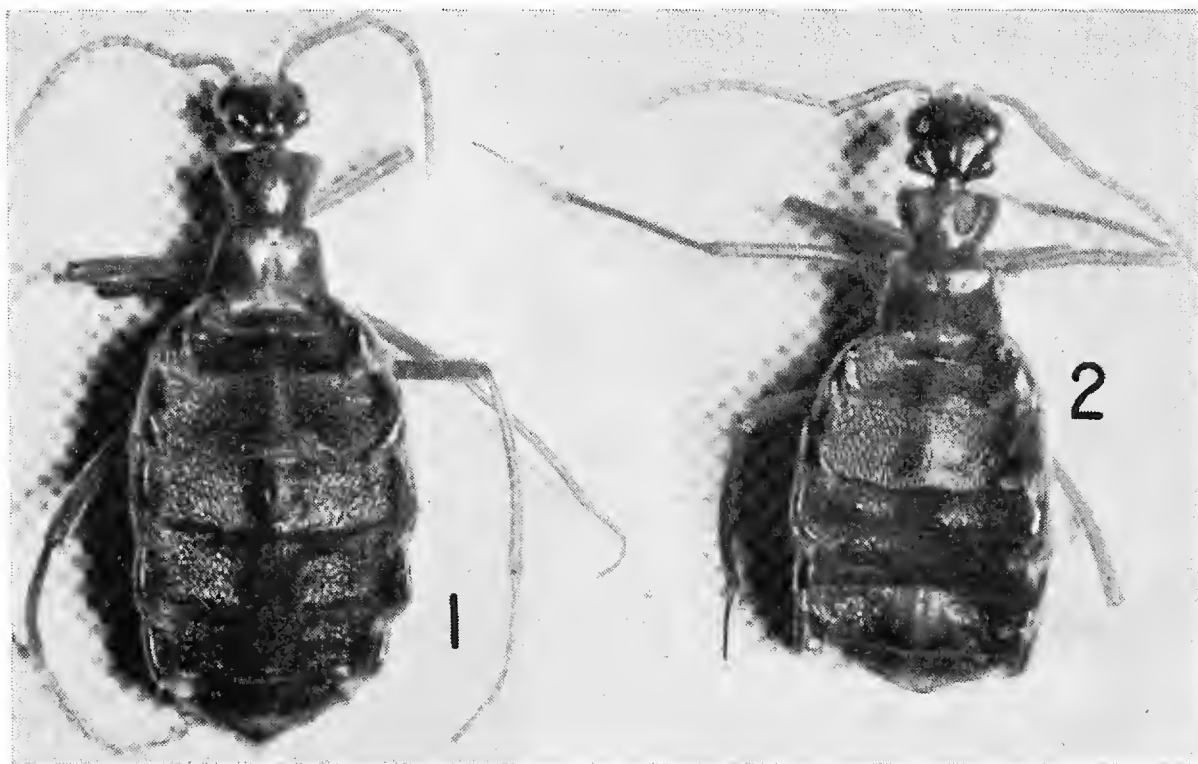
KEY TO SPECIES

- 1. Color reddish brown; posterior projections of the head directed mostly upward so that the head appears rounded behind the eyes (Figs. 4 and 5) when viewed from the dorsal side *rex* Wasmann
Color dark reddish brown, approaching black; posterior projections of the head directed both upward and posteriorly so that the head appears bulbous behind the eyes when viewed from the dorsal side (Figs. 1 and 2) 2
- 2. Head with a raised carinate projection on the posterior median line between the two posterior projections (Figs. 1 and 2) *regina* Kistner
Head without such a raised carinate projection, with the head evenly rounded between the two posterior projections *kisantuensis* Kistner

DORYLOCRATUS REX Wasmann
(Figs. 4-6, 7-8)

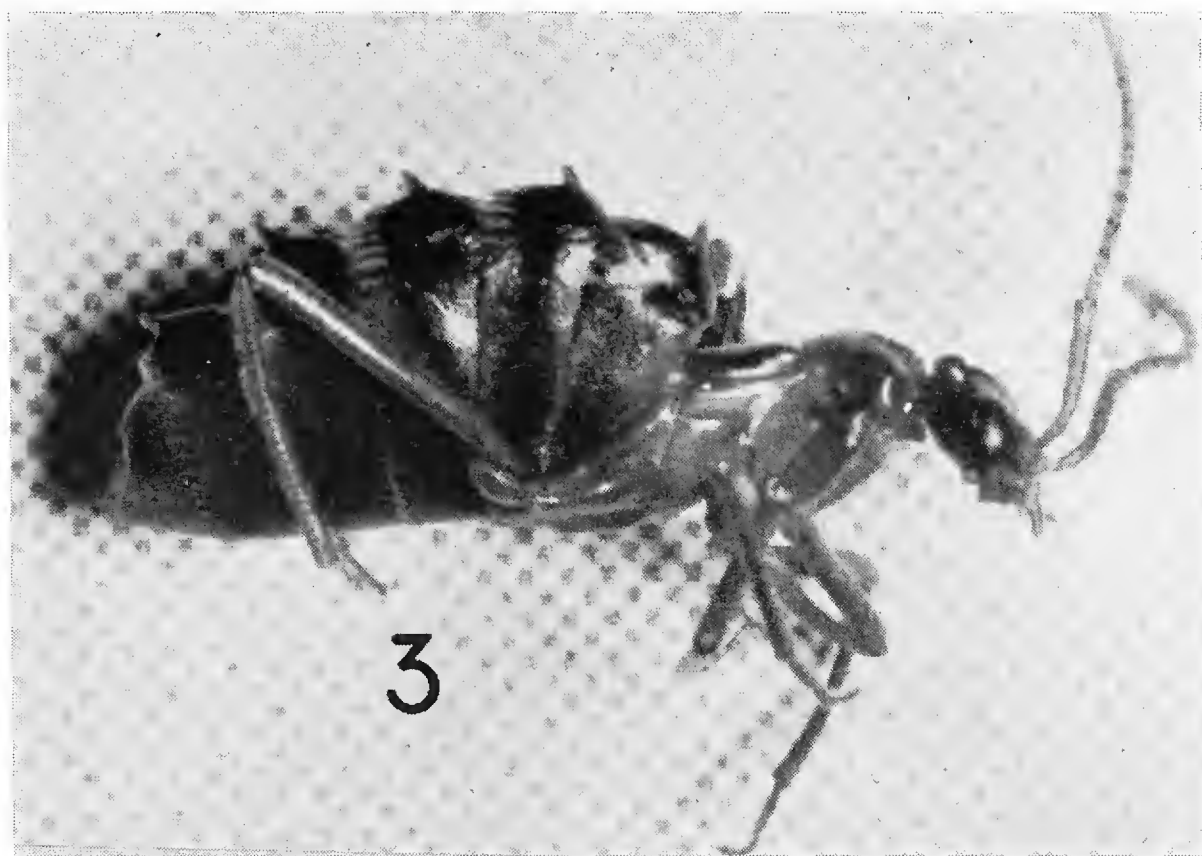
Dorylocratus rex Wasmann, 1916, p. 100, Plate 3, figs. 3, 3a. Naturhistorisches Museum, Maastricht (Congo Republic: St. Gabriel near Stanleyville, from 3 separate columns of *Dorylus* (*Anomma*) *wilverthi* Emery); 1917, p. 281, Plate 8, figs. 14-20.

¹ This study was supported in part by a grant from the National Science Foundation (NSF-GB-1366).
THE PAN-PACIFIC ENTOMOLOGIST 40: 246-254. October 1964



EXPLANATION OF FIGURES

Figs. 1-2. *Dorylocratus regina* Kistner. 1, female, dorsal view. 2, male, dorsal view. Square dots in the background have a side equal to 0.15 mm.



EXPLANATION OF FIGURE

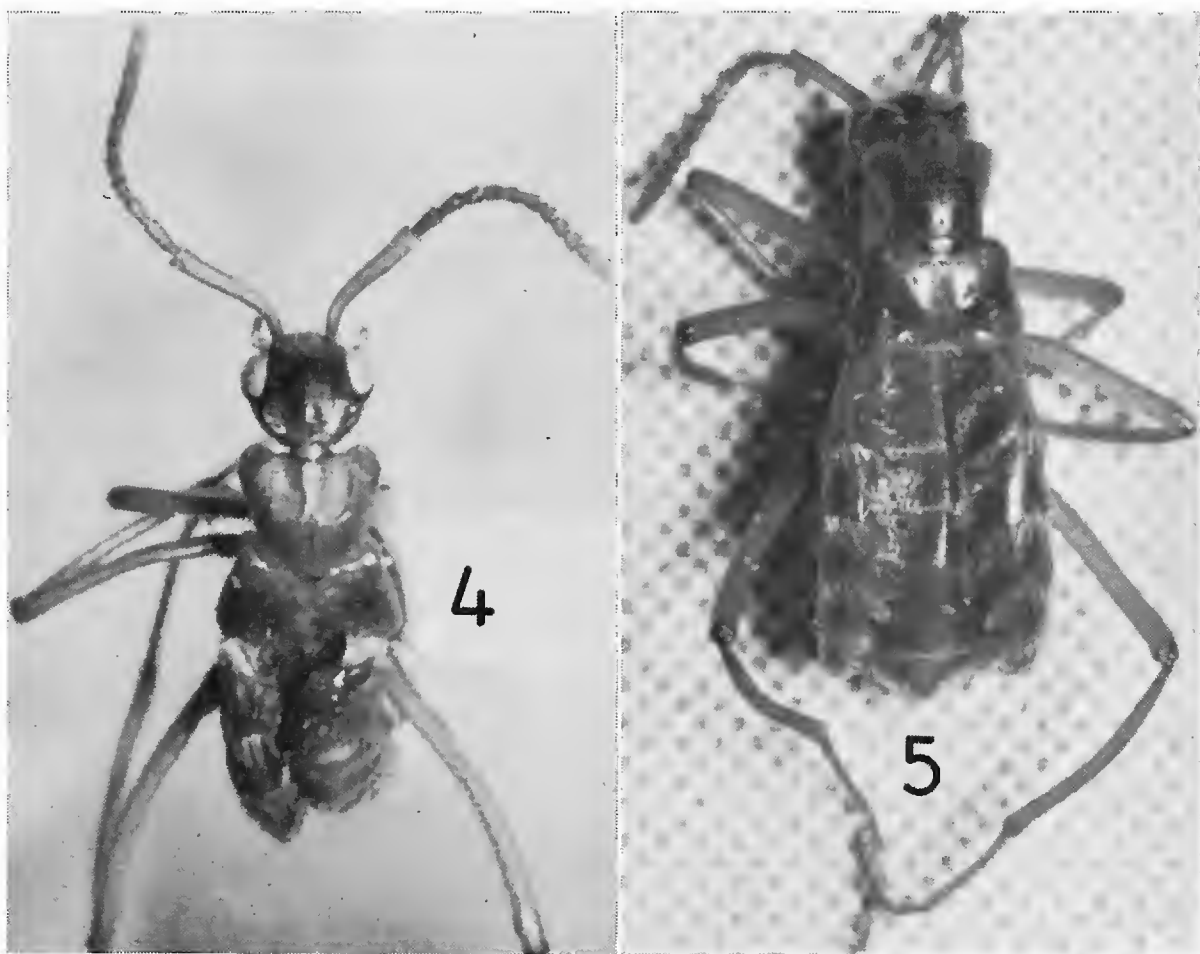
Fig. 3. Lateral view of female *Dorylocratus regina* Kistner. Square dots in the background have a side equal to 0.15 mm.

Distinguished from all other species by the color, the shape of the posterior cephalic prominences, and the shape of the male genitalia.

Color light reddish brown throughout; abdomen somewhat darker. Dorsal surface of the head, pronotum, and elytra with extremely fine bumps scattered sparsely and evenly over them except in the pronotal fossae where the fine bumps are closer together, giving a duller overall appearance. Pronotum with a dark line running longitudinally along the midline; this line is darkest behind the fossae but can be traced forward to a point just short of the anterior border. Posterior cephalic prominences feebly developed upward and backward, but scarcely modify the outline of the head when viewed from the dorsal side (Figs. 4 and 5). Surface of the head between the two lateral prominences forming a carinate (but flattened) dorsal projection. Overall dorsal appearance of female as in Fig. 4. Overall dorsal appearance of male as in Fig. 5. Lateral appearance of male as in Fig. 6. Male genitalia shaped as in Fig. 7. Spermatheca of female shaped as in Fig. 8.

Measurements.—Pronotum length, 0.90–0.91 mm; elytra length, 0.60 mm; head length, 0.92–0.93 mm.

Material examined.—Congo Republic: Yangambi, collected by D. H. and A. C. Kistner and R. Banfill: one female, 27 June 1960, from the central part of an emigration column of *Dorylus (Anomma) wilverthi* Emery, nest No. 14; one male, 29 June 1960, from the central part of a



EXPLANATION OF FIGURES

Figs. 4–5. *Dorylocratus rex* Wasmann. 4, female, dorsal view. 5, male, dorsal view. Square dots in the background have a side equal to 0.15 mm.

raiding column of *D. wilverthi* Emery, nest No. 18. In the collection of D. H. Kistner.

***Dorylocratus regina* Kistner, new species**

(Figs. 1–3, 9–10)

Distinguished from all other species by the color, the shape of the posterior cephalic prominences, the shape of the median posterior carina of the head, and the shape of the male genitalia.

Color dark reddish brown throughout; abdomen somewhat darker, approaching black. Dorsal surface of the head, pronotum, and elytra with extremely fine bumps scattered sparsely and evenly over them except in the pronotal fossae where the fine bumps are closer together giving a duller overall appearance. Pronotum with a dark line running longitudinally along the midline; this line is darkest behind the fossae but can be traced forward to a point just behind the anterior border. Posterior cephalic prominences very well developed, both upward and backward, in such a way as to significantly modify the outline of the head when viewed from the dorsal side (Figs. 1 and 2). Surface of the head between the two posterior prominences forming a carinate dorsal projection (Figs. 1 and 2). Overall dorsal appearance of female as in Fig. 1. Overall dorsal appearance of male as in Fig. 2. Overall lateral appearance of female as in Fig. 3. Male genitalia shaped as in Fig. 9. Spermatheca shaped as in Fig. 10.

Measurements.—Pronotum length, 0.78–0.85 mm; elytra length, 0.60 mm; head length, 0.82–0.95 mm. Number measured, four.

Holotype male.—No. 9665, LIBERIA, CHARLESVILLE, 21 June 1962, from the central part of a raiding column of *Dorylus (Anomma) nigricans sjoestedti* Emery, nest No. 62, coll. D. H. and A. C. Kistner. In the collection of D. H. Kistner.

Paratypes.—One male, same data as holotype; two females, Liberia, Charlesville, 19 June 1962, from the central part of a raiding column of *Dorylus (Anomma) nigricans sjoestedti* Emery, nest No. 62, coll. D. H. and A. C. Kistner. All in the collection of D. H. Kistner.

***Dorylocratus kisantuensis* Kistner, new species**

Distinguished from all other species by the shape of the posterior cephalic prominences and by the shape of the median posterior carina of the head between the two posterior cephalic prominences.

Color dark reddish brown throughout; abdomen somewhat darker, approaching black. Dorsal surface of the head, pronotum, and elytra with extremely fine bumps scattered sparsely and evenly over them except in the pronotal fossae where the fine bumps are closer together giving a duller overall appearance. Pronotum with a dark line running longitudinally along the midline; this line is darkest behind the fossae but can be traced forward to a point just behind the anterior border. Posterior cephalic prominences very well developed, both upward and backward in such a way as to significantly modify the outline of the head when viewed from the dorsal side; shaped as in *D. regina* Kistner (Figs. 4 and 5). Surface of the head between the two posterior prominences is smoothly rounded, without a carinate dorsal projec-

tion. Overall dorsal and lateral appearance of female very close to *D. regina* Kistner (Figs. 4 and 6). Spermatheca shaped as in *D. regina* Kistner. Male unknown.

Measurements.—Pronotum length, 0.78 mm; elytra length, 0.60 mm; head length, 0.84 mm. Number measured, one.

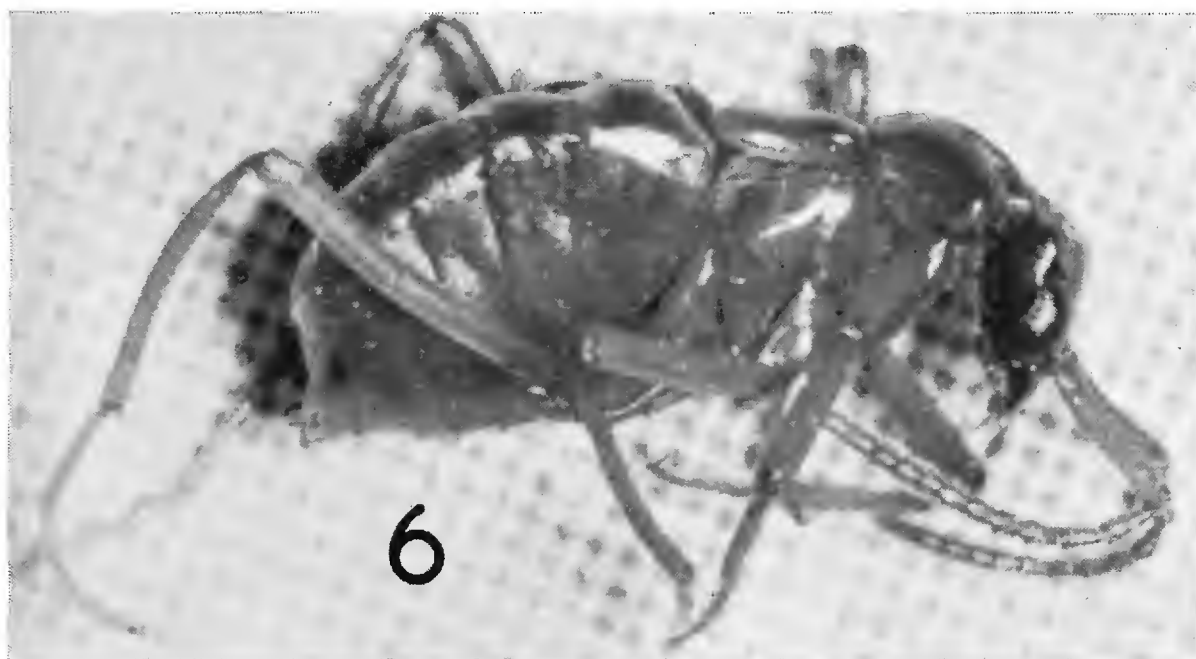
Holotype female.—No. 9199, CONGO REPUBLIC, KIVU, KISANTU, 3 January 1926, with *Dorylus (Anomma)* sp., coll. R. P. Hulstaert. In the collection of the Musée Royal de l'Afrique Centrale, Tervuren.

MORPHOLOGICAL NOTES ON THE GENUS

Most of the important morphological features of the genus were given by Seevers (1964). To his account I should like to add the following:

The wings were torn off of all specimens examined. The specimens were carefully handled both in the field and in the laboratory but when the elytra were raised only stumps of an otherwise normal wing were located. This suggests that they have full-sized wings at an early stage of their adult life, but these are lost during their life in the ant colony. Perhaps as in *Jeanneluisa* Bernhauer, they cannot be refolded under the elytra because of abdominal modifications and hence are soon lost when in contact with the ants.

The spermatheca is highly modified in this genus (see Figs. 8 and 10). The foot of the spermatheca is placed on the endosternite of segment VIII with the pointed part posterior. From each side of the pointed part is a membranous piece which extends laterally to the side of the abdomen. It is not clear to me just how this functions or if it functions as a spermatheca. It is simply located where the spermatheca is usually placed.



EXPLANATION OF FIGURE

Fig. 6. Lateral view of male *Dorylocratus rex* Wasmann. Square dots in the background have a side equal to 0.15 mm.

BEHAVIOR OF THE SPECIES

All of the species of the genus appear to be quite rare. An idea of how rare they are can be derived from the proportion of the total sample of myrmecophiles we took at each locality. At Yangambi, Congo Republic, *Dorylocratus rex* Wasmann was represented by 2 specimens out of about 13,000. In Charlesville, Liberia, *Dorylocratus regina* new species, was represented by 4 specimens out of about 1,800. These samples are about as objective as they can be as all the collectors were told to get every myrmecophile they saw. But if the sample is biased, it would be biased toward getting more *Dorylocratus* as they are relatively large in size, instantly recognizable in the columns, and perhaps the fanciest dorylophile to be found.

Dorylocratus rex Wasmann from the Congo Republic was collected first. The following protocols were recorded in our notebook about its behavior.

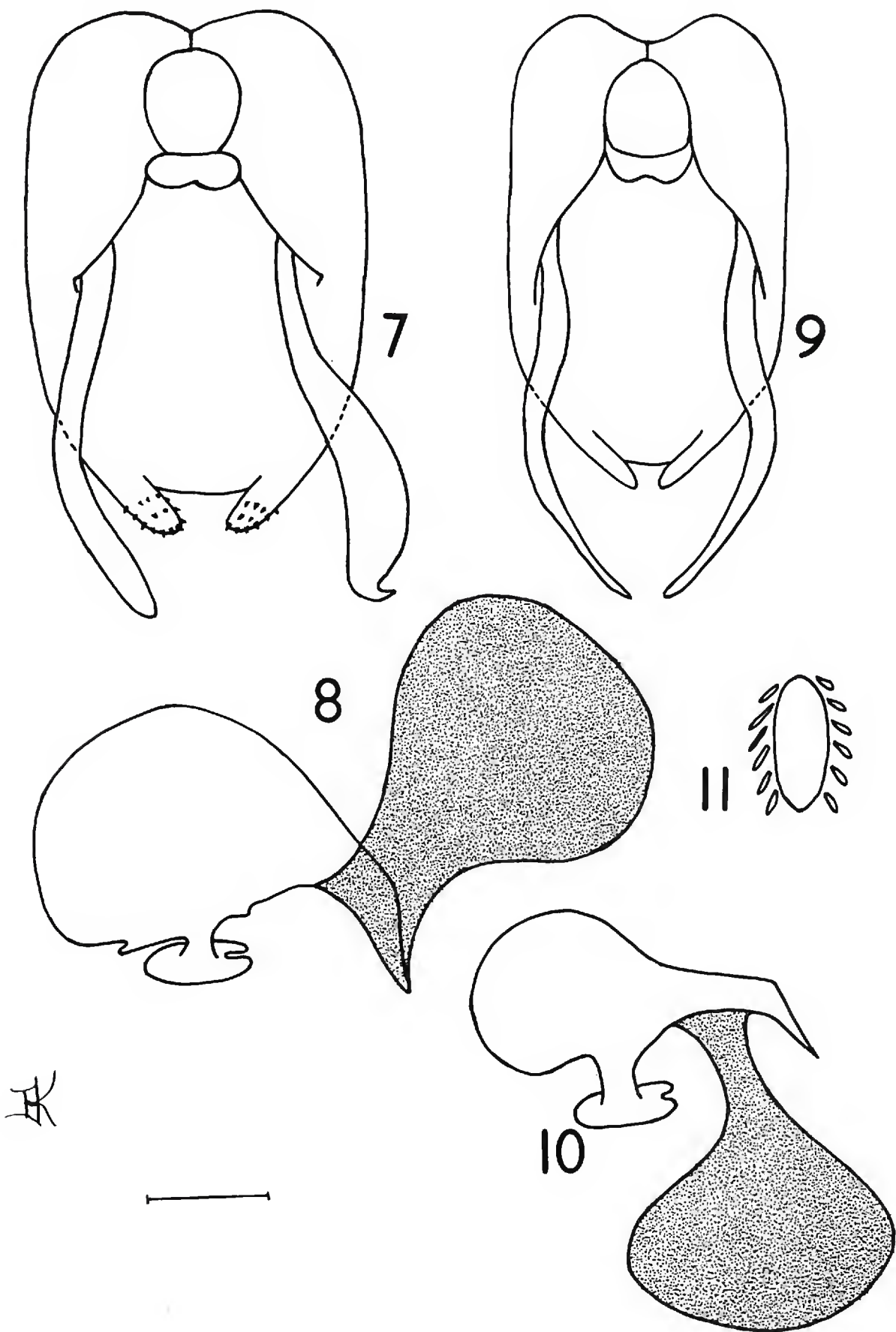
Yangambi, 27 June 1960, nest No. 14, emigration column, discovered that morning. By 2:00 p.m., the larvae and pupae had all been carried across the section of the column that I was working but the worker ants continued coming. Among these worker ants were large numbers of myrmecophiles. One large *Dorylocratus* was captured and another seen, but it escaped. Both progressed down the column surrounded by a crowd of minim workers which were all pushing forward and into the *Dorylocratus* at the same time (see diagram in Fig. 11). Although major workers were present in the column, they seemed to walk past the *Dorylocratus* without notice or change in pace. The minim workers seemed to take licks at the abdomen of the *Dorylocratus* and to move their antennae over their abdomen as they went walking by. The beetles progressed clumsily along in the columns.

Yangambi, 29 June 1960, nest No. 18, raiding column discovered early in the morning and collected from all day. The *Dorylocratus* was captured about 1:00 p.m. when the column was thick with workers returning to the nest with booty. The *Dorylocratus* came walking through the maze of ants going away from the nest. This specimen was not attended by a crowd of minim workers but was walking through without causing a ripple of excitement. Many ants would wave their antennae over the body and then continue on their way.

It is noteworthy at this point to state that the specimen captured on 27 June was a female and the specimen captured on 29 June was a male. Freshly killed specimens show a great deal of membrane surrounding the fimbriated edges of the abdomen. The abdomen is more inflated and the fimbriated edges of the abdomen show more membranous development in females than in males.

The other species observed was *Dorylocratus regina* Kistner from Liberia. The following protocols were recorded:

Charlesville, 19 June 1962, nest No. 62, raiding column which had started during the early morning and was well established when we dis-



covered it about 8:00 a.m. The *Dorylocratus* were captured around 10:00 a.m. walking out from the nest in a column in which many workers were returning with booty. Again both specimens captured were surrounded by about 10–15 minim workers which were pushing inward toward the *Dorylocratus* at the same time as they were moving forward. While the minim workers were moving they would move their antennae over the abdomen and move their mouthparts over the fimbriated margins of the sternites.

Charlesville, 21 June 1962, nest No. 62, another raiding column which had started before dawn and was well established when we found it about 8:00 a.m. One *Dorylocratus* was captured moving out from the nest in a column thick with returning workers carrying booty. This specimen was unattended by minim workers but was “felt” by the antennae of workers which it encountered. The second specimen was captured about 4:00 p.m. very near the nest when the raid was ending and all the workers were returning to the nest with or without booty. The *Dorylocratus* was returning to the nest also unaccompanied by the crowd of minim workers. This is a time when excitement within the column is at a low ebb and the *Dorylocratus* was walking along with scarcely an encounter with the ants.

It is noteworthy to state here that the two specimens captured on 19 June were females whereas the two specimens captured on 21 June were males.

In view of the above observations, the following interpretations are tentatively offered. If these were common insects, I should probably wait for more observations, but in view of the fact that only 13 specimens have been recorded in the last 50 years (three of these, which had been captured in Ethiopia by Patrizi and Meneghetti (Patrizi 1951), were lost during World War II), I would like to offer them anyway.

1. Specimens are to be found both in raiding columns and emigration columns. Although Patrizi (1951) recorded them only in association with the brood and emigration columns, Wasmann (1916, 1917) recorded them from raiding columns and our data show them in both situations.

2. The inflated abdomen with its membrane-covered, fimbriated edges

←

EXPLANATION OF FIGURES

Figs. 7, 9. Male genitalia, ventral views: 7, *Dorylocratus rex* Wasmann. 9, *D. regina* Kistner. Figs. 8, 10. Spermathecae (stippled area membranous): 8, *D. rex* Wasmann; 10, *D. regina* Kistner. Fig. 11. Diagram to show relations of a *Dorylocratus* sp. female to the minim worker ants as they progress through the column. The large ellipse represents the *Dorylocratus* and the small ones ants. They are progressing towards the top of the page. The scale represents 0.25 mm and applies to Figs. 7–10.

of the sternites probably has some secretory function. This function seems to be more developed in females than in males. The males, whose abdomens are less inflated than females, are more ant-like in appearance and seem to be able to pass antennal scrutiny without any obvious exudation.

3. Only minor workers were ever seen engaged in behavior which suggests that they were licking the beetles. Although major workers were abundant in the columns, they seemed to ignore the *Dorylocratus* altogether. We have data on other species (including an histerid) showing the same type of behavior which we shall publish later when determinations are available.

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Notes and Description of the Previously Unknown

Male of *Syntaxis libocedrii*

(Hymenoptera : Syntexidae)

WOODROW W. MIDDLEKAUFF

University of California, Berkeley

In a recent shipment of siricids sent to me by Mr. Boyd E. Wickman¹ for identification were eight males and seven females of the extremely rare *Syntaxis libocedrii* Rohwer.

Rohwer (1915) based the original description of this species upon two females from Rose Camp, Georgetown, El Dorado County, California which were reared from the incense cedar, *Libocedrus decurrens* Torr. Prior to the recent collections of the specimens here reported, only the two females from the type series and an incompletely labeled female from the Modoc National Forest have previously been known to me.

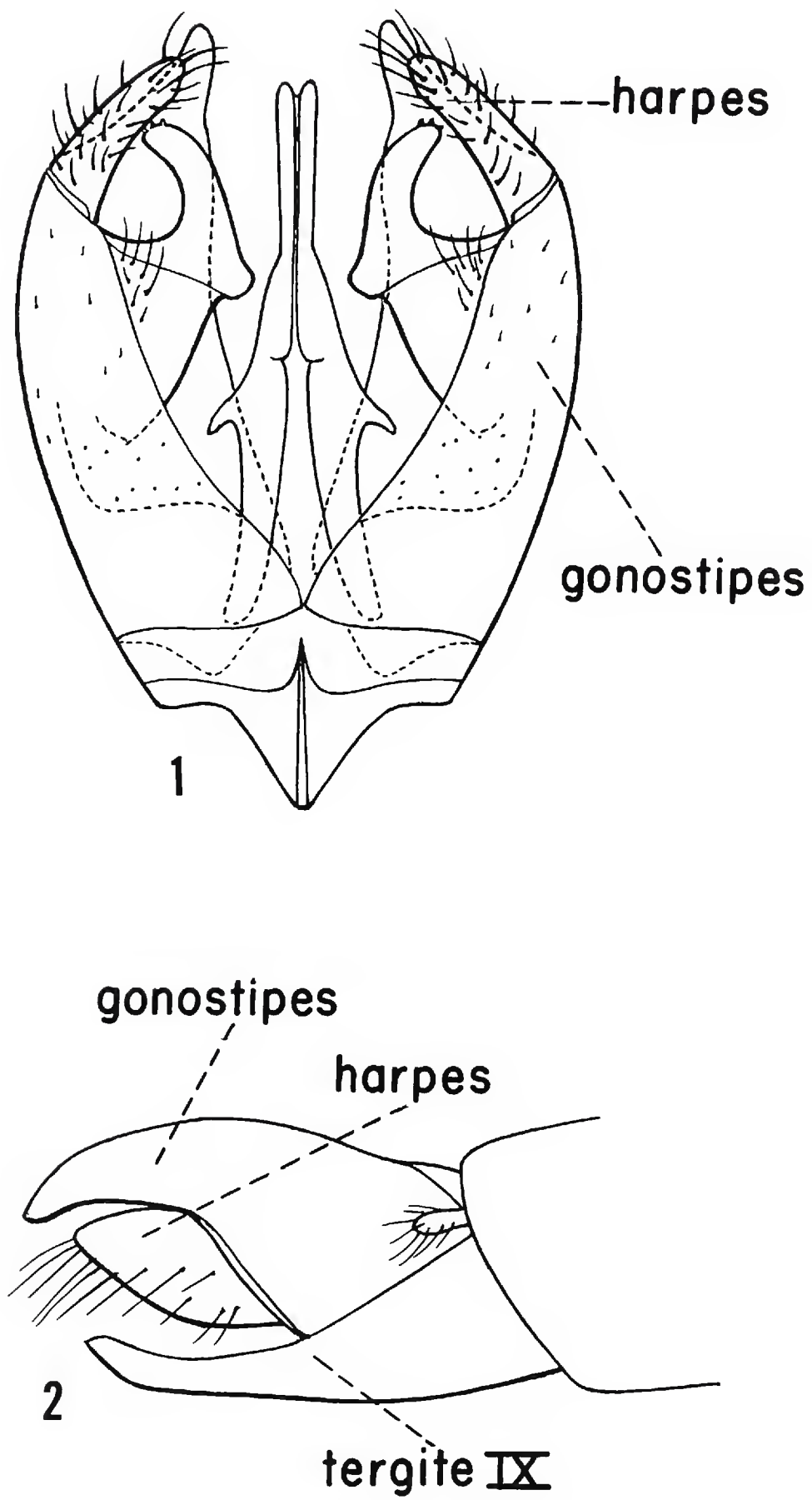
Dr. H. H. Ross has informed me that there is a specimen at Urbana with an old C. C. Adams number for which they were never able to obtain data. Dr. B. D. Burks confirmed that only the two females previously referred to, and one other tattered female from the stomach of a nighthawk, are at the U. S. National Museum.

The present specimens vary greatly in size, a phenomenon quite common in some other wood-boring Hymenoptera and Coleoptera, notably siricids and cerambycids. Females range from 4.6 to 13.3 mm in length (head to tip of tergite X) and the males 7.7 to 9 mm. Rohwer (1915) reported the length of the holotype female as 8 mm.

Syntaxis, in common with a number of other insects which attack recently dead or dying trees, is apparently attracted to forest burn areas soon after late summer or early fall forest fires. The series of males taken by Wickman at Viola was collected either on sticky bands placed on the trunks, or crawling over the bark of several species of pine, white fir, and incense cedar immediately following a fire. The tree trunks were still warm and smoking at the time of collection. The four females taken by Litsinger in the South Fork District of Modoc National Forest were taken on burned timber 1 day following a burn.

The three females reared from *Libocedrus* came from a tree which had been burned in the Montgomery Creek forest fire in August 1961. It was cut the following summer and they emerged in August 1962. It therefore appears that the life cycle can be completed in 1 year.

¹ Pacific Southwest Forest and Range Experiment Station, U.S.D.A., Berkeley.



EXPLANATION OF FIGURES

Figs. 1 and 2, Genitalia of male *Syntexis libocedrii* Rohwer: 1, ventral view; 2, lateral view.

Since the male has previously been unknown, the following description is given:

MALE.—Mandibles and legs beyond middle of femora, except apical tarsal segments, brownish (rufo-testaceous). A narrow line on inner orbits from middle of eye to anterior malar space and continuing as a broader band from posterior malar space on posterior orbits along eye margin to level of the top of the eye; a narrow line on posterior margin of pronotum which terminates at the posterior lateral angles and then continues on the posterior lateral margin as a very narrow line; a narrow line on the lateral posterior margins of all abdominal tergites, extending around margins of the lateral abdominal tergites; and a narrow, apical line on all abdominal sternites, straw-white. Remainder of appendages and body, black.

Except for sexual differences, morphological features of head and body similar to female (*vide* Rohwer, 1915).

Genitalia as in Figs. 1 and 2. The peculiar crab-claw shape of the harpes and gonostipes is unlike the genitalia of any other sawfly known to me. There is no discernible gonomacula present.

New Locality Records (California):

MODOC CO.: Modoc National Forest, ♀, no date, in flight, No. 18247D (K. A. Salmon, Gerald Stage). South Fork District (26 miles south Alturas), Modoc National Forest, 4 ♀♀, 29 July 1960 (J. A. Litsinger, U.S.D.A.² and C.I.S.³). SHASTA CO.: Montgomery Creek, 3 ♀♀, emerged 18, 26 July 1962 from log sections of fire killed *Libocedrus decurrens* (B. E. Wickman, U.S.D.A. and C.I.S.). VIOLA, 8 ♂♂, 20, 21 July 1963, trapped on sticky bands or netted on trunks of *Libocedrus decurrens*, *Pinus ponderosa*, and *Abies concolor* (B. E. Wickman, U.S.D.A. and C.I.S.).

Rohwer (1915) placed *Syntaxis* in the family Cephidae but as pointed out by Benson (1935) it is more closely related to the Xiphydriidae, the two having similar antennae, mesopleurae, wing venation, and type of head. It differs from the Cephidae in a number of important aspects, such as having a genaponta instead of a maxaponta, possessing cenchri with the concomitant presence of the scaly patch on the base of the anterior wings, and lacking the constriction between the first and second abdominal segments. *Syntaxis* differs from Xiphydriidae, as pointed out by Ross (1937), in lacking the transverse suture of the mesoscutum, and in having a wide trench between the mesonotum and metanotum. It was on the basis of these and other differences that Benson (1935) raised *Syntaxis* to family rank. Additional support for this status can be found in the unique crab-claw formed by the gonostipes and harpes and the longitudinal suture-like line on the mid pronotum.

^{2, 3} Indicates present repository of specimens. U.S.D.A., Pacific Southwest Forest and Range Experiment Station, Berkeley; C.I.S., California Insect Survey, University of California, Berkeley.

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-

ZOOLOGICAL NOMENCLATURE: Notice of proposed use of plenary powers in certain cases (A. [n.s.] 65).

In accordance with a decision of the 13th International Congress of Zoology, 1948, public notice is hereby given of the possible use by the International Commission on Zoological Nomenclature of its plenary powers in connection with the following cases, full details of which will be found in *Bulletin of Zoological Nomenclature*, Vol. 21, Part 4, published on 16 October 1964.

- (7) Emendation to *Astraeus* of the generic name *Asthraeus* Laporte & Gory, 1837 (Insecta, Coleoptera). Z.N.(S.) 1628;
- (8) Validation of *Rhyncogonus* Sharp, 1885 (Insecta, Coleoptera). Z.N.(S.) 1629.

Any zoologist who wishes to comment on any of the above cases should do so in writing, and in duplicate, as soon as possible, and in any case before 16 April 1965. Each comment should bear the reference number of the case in question. Comments received early enough will be published in the *Bulletin of Zoological Nomenclature*. Those received too late for publication will, if received before 16 April 1965, be brought to the attention of the Commission at the time of commencement of voting.

All communications on the above subject should be addressed as follows: The Secretary, International Commission on Zoological Nomenclature, c/o British Museum (Natural History), Cromwell Road, London, S. W. 7, England.—W. E. CHINA, *Acting Secretary to the International Commission on Zoological Nomenclature*.

**Observations on Oviposition Habits of *Sirex longicauda*
and *Urocerus californicus***

(Hymenoptera : Siricidae)

BOYD E. WICKMAN

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U. S. Department of Agriculture, Berkeley, California*

The oviposition habits of two California siricids, *Sirex longicauda* Middlekauff and *Urocerus californicus* Norton, resemble those reported by Chrystal (1928) and Rawlings (1951) for European species. Observations of the North American siricids were made in the course of studies on insects causing degrade in lumber cut from fire-damaged and windthrown trees. Their oviposition habits have never been reported.

On 9 October 1963, a female *S. longicauda* was observed ovipositing on red fir, *Abies magnifica* A. Murr., at Summit Lake, Lassen Volcanic National Park, California. The 24-inch-diameter tree was broken off 50 feet above the ground by wind in October 1962, but was still alive. The thermograph-recorded air temperature was 9° C; there were intermittent clouds and southerly winds estimated at 5 to 15 mph.

The insect was found at 1 p.m. in a bark crevice on the sunny side of the tree, oriented head up. Almost the entire length of her ovipositor was inserted. Her abdomen pulsated rapidly in a circular motion until its tip touched the bark. She remained in this position for 5 minutes, then began struggling—evidently unable to free her ovipositor. After 10 minutes of useless struggling by the insect, an attempt was made to free the ovipositor with forceps, but the thin tube broke off, several eggs oozing from the break.

This oviposition occurred in much cooler temperature than previously reported by Rawlings, who found 26° C the optimum temperature for ovipositing, the process slowing down at 21° C. The oviposition site at Summit Lake, however, was in full sunshine; reflected and absorbed heat in the deep bark crevice was undoubtedly higher than air temperature.

Two female *U. californicus* were captured in 10° C temperature while resting on freshly cut red fir logs at Hat Creek, California, on 11 October 1963. They were caged with a small white fir, *Abies concolor* (Gord. and Glend.) Lindl., log. The log had been cut a few days earlier from a tree windthrown in October 1962. It had a moisture content of 52 per cent. A wire cage with glass door was placed in the laboratory.

A bank of fluorescent lights above and to one side of the cage allowed one side of the standing log to be shaded. The room temperature was kept at 25° C with an electric space heater, and relative humidity was about 70 per cent for 2 hours, with no oviposition taking place.

Shortly after the temperature was lowered to 20° C, both insects began ovipositing. They drilled oviposition holes repeatedly throughout the day, often alternating oviposition with several minutes' flight against the glass window. In all observed instances except two, the oviposition took place with the head oriented upward. In one of the exceptions, the body was oriented horizontally on the log; in the other, the head was downward. There seemed to be no preference shown for the shady or well-lit side of the log.

The insects continued ovipositing at a diminishing rate the second day on a fresh ponderosa pine, *Pinus ponderosa* Laws., log inserted in the cage. On the third day both insects were moribund.

During all observations the insects explored possible sites, especially bark crevices, with their antennae, then probed with their ovipositor and sheath, usually several times, before finding the drilling spot. Then the female arched her abdomen, placing her weight on the ovipositor sheath and on the prothoracic and mesothoracic legs. When she was firmly in place, the valves of the sheath returned to their original horizontal position and she inserted the thin, tube-like ovipositor in a rapid circular motion accompanied by a rhythmic pulsation of her abdomen.

One individual continually oviposited as deeply as her ovipositor would allow (20 mm); the entire operation consistently took about 10 minutes: 5 minutes for insertion, 2 minutes for egg laying, and 2 to 3 minutes for withdrawal. Some eggs were probably laid during withdrawal.

The other insect was less consistent, several times inserting her ovipositor (26 mm long) only 5 to 10 mm in a 5-minute operation. Whether she laid eggs or not could not be determined.

Chrystal found that *S. gigas* L. took 8 to 9 minutes to oviposit, and laid three to six eggs in each tunnel, several as the ovipositor was withdrawn. Both Chrystal and Rawlings reported that sometimes no eggs were laid in an oviposition tunnel. Rawlings attributed this habit to the siricid female's aversion to resin ducts. The insect withdrew immediately upon encountering a resin duct.

Oviposition habits of the two California species were very similar to those reported for European species except for the surprising temperature relationships. The two cases observed indicated that California siricids can oviposit at lower temperatures than expected. This dif-

ference might be partially explained by the sudden cold period which interrupted an attacking siricid population in October 1963.

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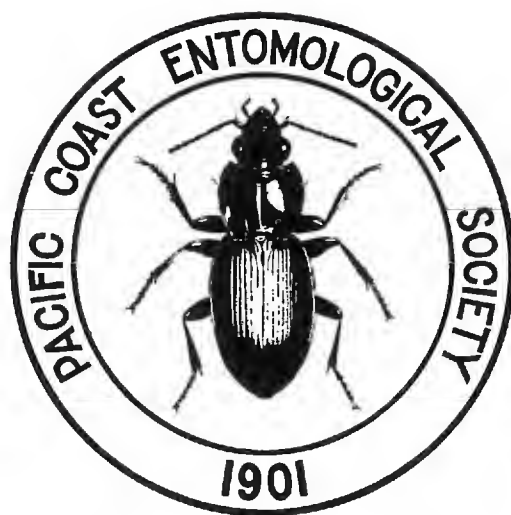
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MAILING DATES FOR VOLUME 40

- No. 1 30 March 1964
 No. 2 26 June 1964
 No. 3 2 September 1964
 No. 4 28 October 1964



Published by the
Pacific Coast Entomological Society
in cooperation with
The California Academy of Sciences

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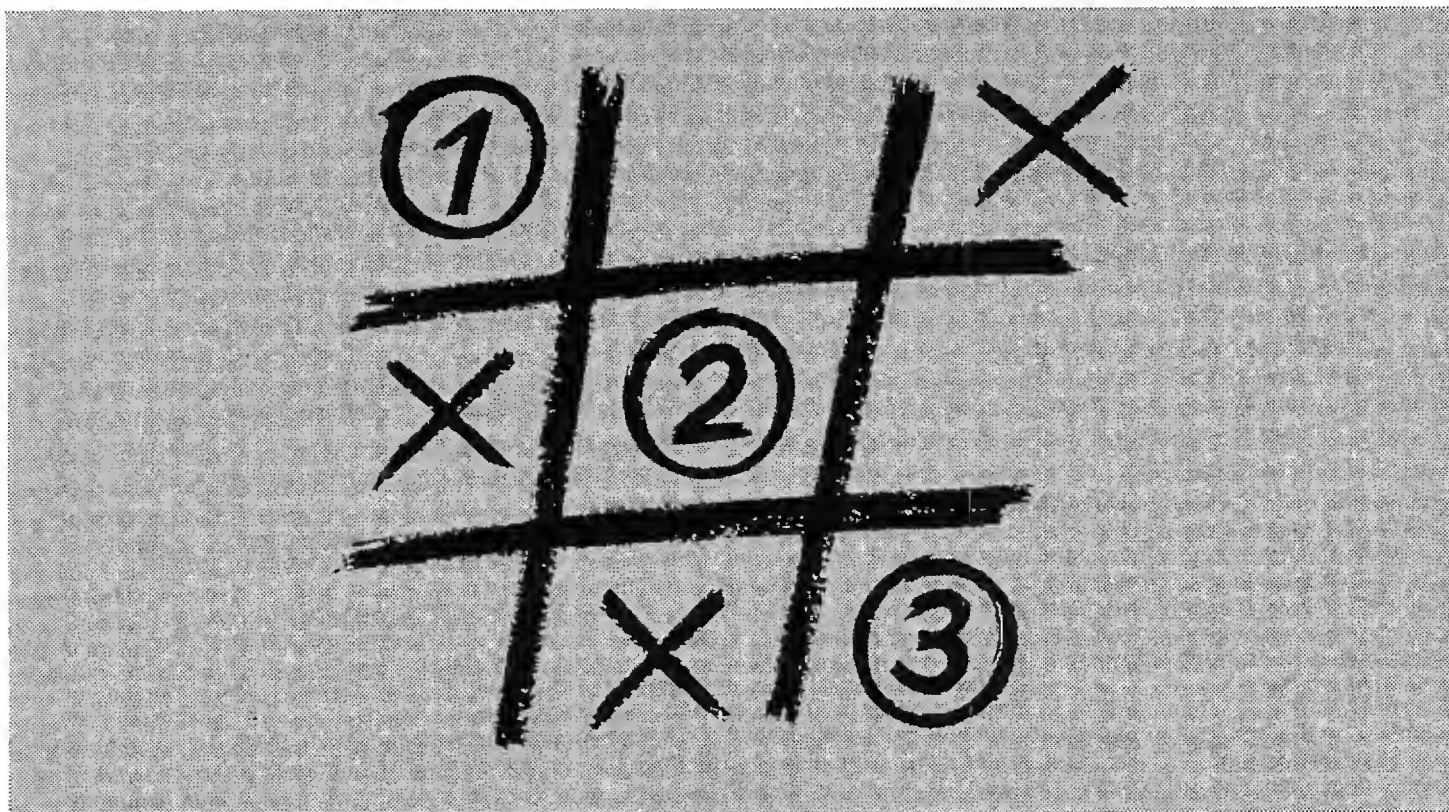
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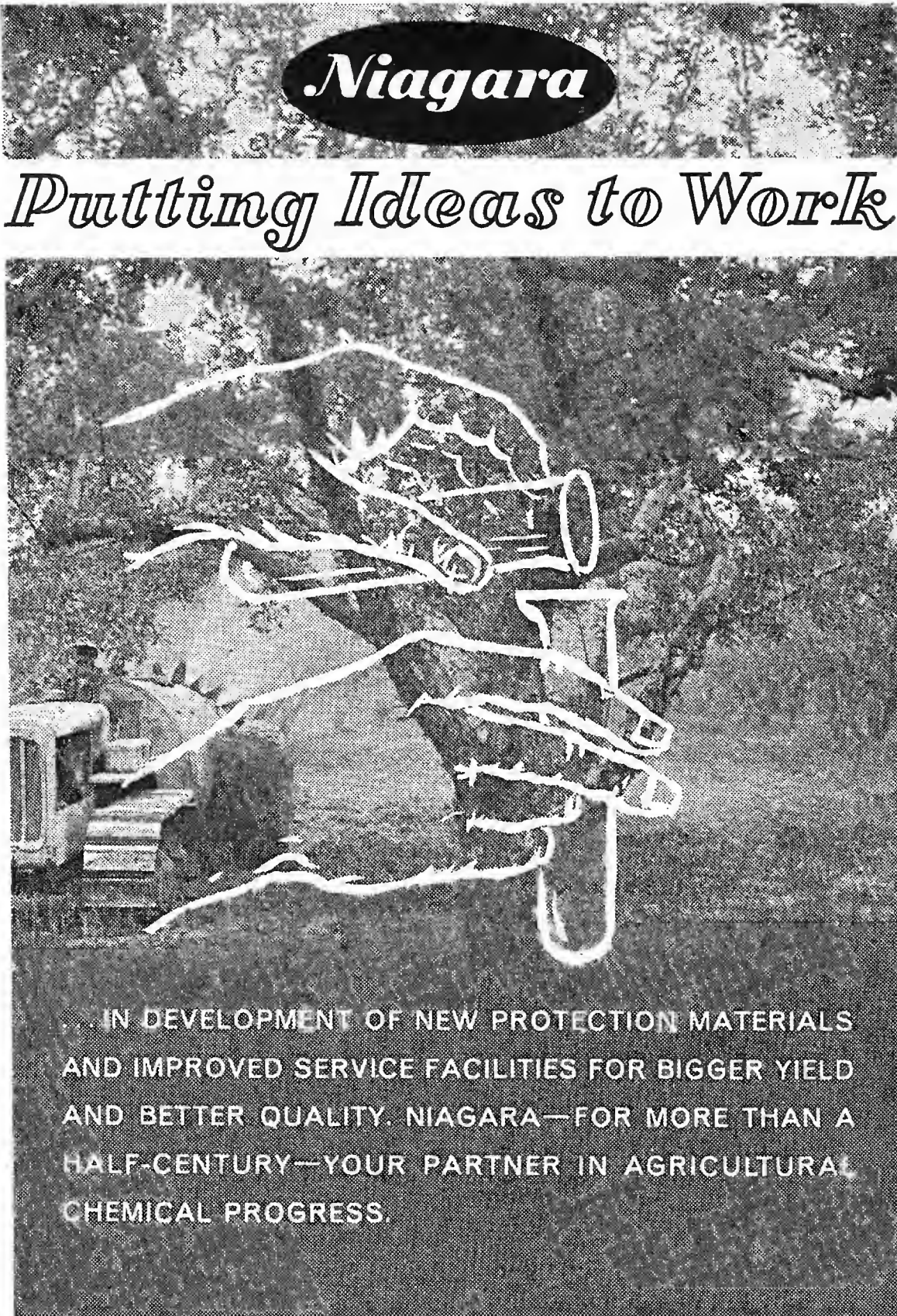
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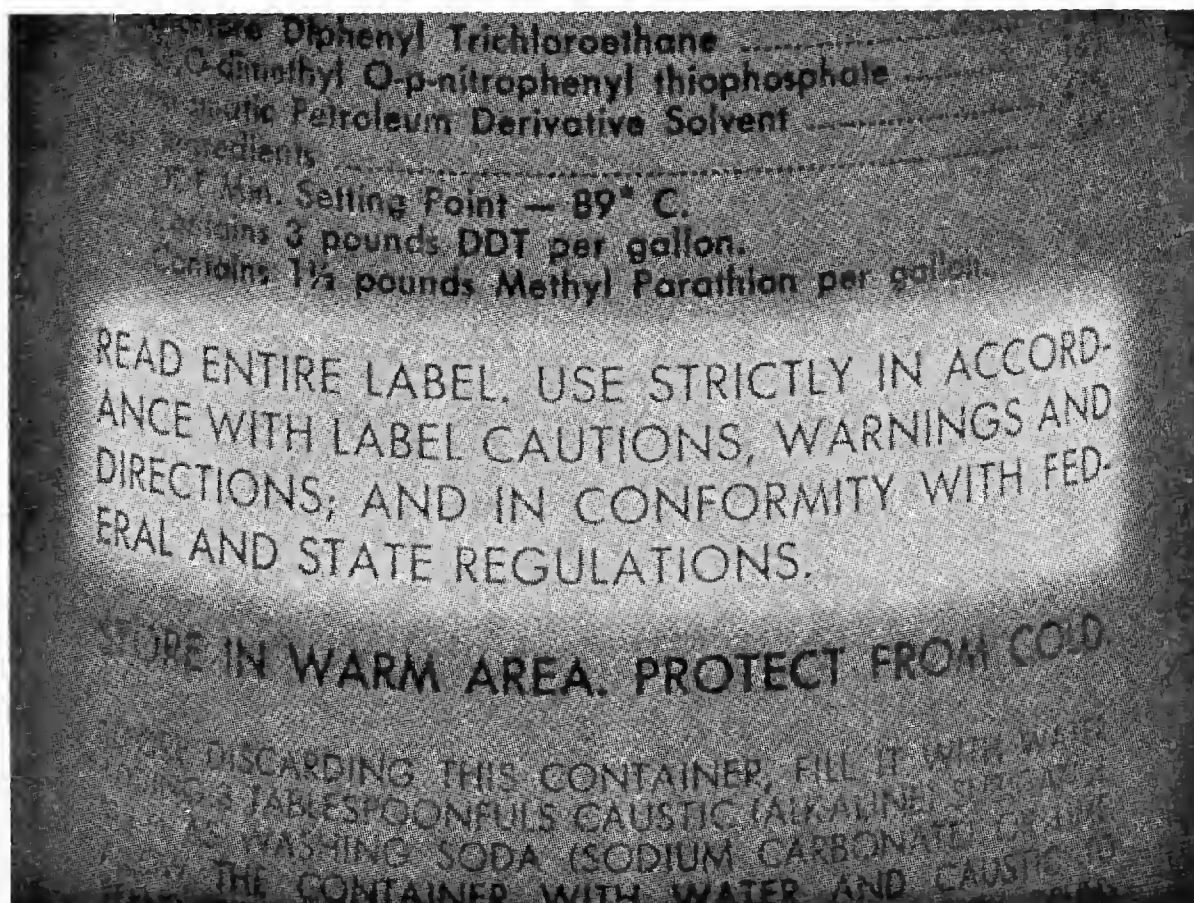
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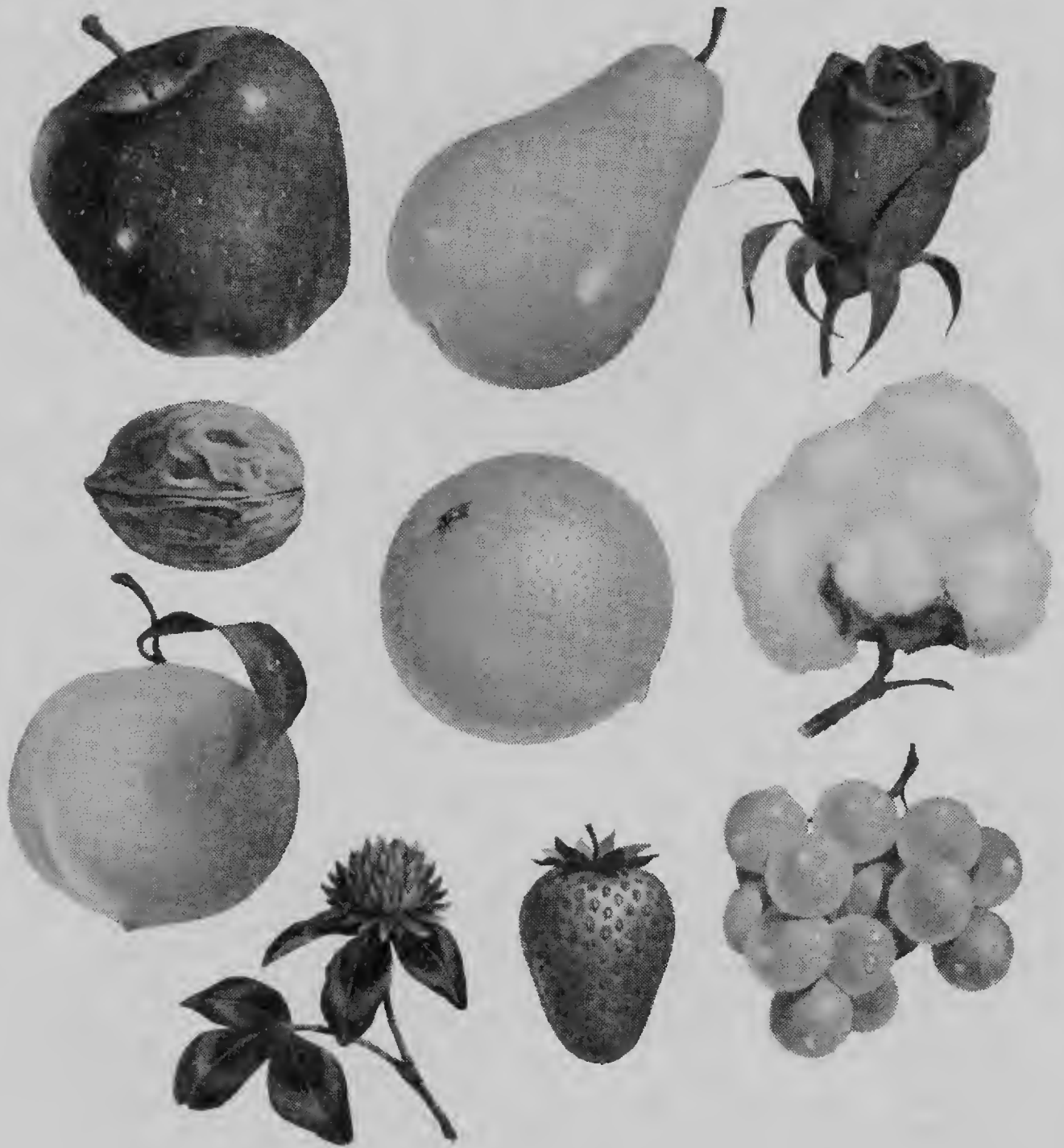
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